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SC PUBLIC SERVICE COMMISSION

November 13, 2008

Mr. Charles Terreni
Chief Clerk
Public Service Commission of South Carolina
Synergy business Park, Saluda Building
101 Executive Center Drive
Columbia, SC 29210

In Re: Combined Application of South Carolina Electric & Gas Company for a Certificate of Environmental Compatibility and Public Convenience and Necessity and for a Base Load Review Order for the Construction and Operation of a Nuclear Facility at Jenkinsville, South Carolina
Docket No. 2008-196-E

Dear Mr. Terreni:

Enclosed please find for filing and consideration twenty-five (25) copies of the Surrebuttal Testimony and Exhibits of Nancy Brockway on behalf of Friends of the Earth, together with Certificate of Service reflecting service upon all parties of record.

With kind regards I am

Sincerely,

Robert Guild

Encl.s
CC: All Parties

RETURN DATE: OK D Duke
SERVICE: OK D Duke

STATE OF SOUTH CAROLINA	)	**BEFORE THE PUBLIC SERVICE COMMISSION OF SOUTH CAROLINA**
(Caption of Case)	)	
In Re: Combined Application of South Carolina Electric & Gas Company for a Certificate of Environmental Compatibility and Public Convenience and Necessity and for a Base Load Review Order for the Construction and Operation of a Nuclear Facility at Jenkinsv	)	**COVER SHEET**
	)	**DOCKET NUMBER:** 2008 - 196 - E

(Please type or print)

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DOCKETING INFORMATION (Check all that apply)

☐ **Emergency Relief demanded in petition** ☐ **Request for item to be placed on Commission's Agenda expeditiously**

☐ **Other:**

INDUSTRY (Check one)	**NATURE OF ACTION (Check all that apply)**		
☒ Electric	☐ Affidavit	☐ Letter	☐ Request
☐ Electric/Gas	☐ Agreement	☐ Memorandum	☐ Request for Certificatio
☐ Electric/Telecommunications	☐ Answer	☐ Motion	☐ Request for Investigatior
☐ Electric/Water	☐ Appellate Review	☐ Objection	☐ Resale Agreement
☐ Electric/Water/Telecom.	☐ Application	☐ Petition	☐ Resale Amendment
☐ Electric/Water/Sewer	☐ Brief	☐ Petition for Reconsideration	☐ Reservation Letter
☐ Gas	☐ Certificate	☐ Petition for Rulemaking	☐ Response
☐ Railroad	☐ Comments	☐ Petition for Rule to Show Cause	☐ Response to Discovery
☐ Sewer	☐ Complaint	☐ Petition to Intervene	☐ Return to Petition
☐ Telecommunications	☐ Consent Order	☐ Petition to Intervene Out of Time	☐ Stipulation
☐ Transportation	☐ Discovery	☒ Prefiled Testimony	☐ Subpoena
☐ Water	☒ Exhibit	☐ Promotion	☐ Tariff
☐ Water/Sewer	☐ Expedited Consideration	☐ Proposed Order	☐ Other:
☐ Administrative Matter	☐ Interconnection Agreement	☐ Protest	
☐ Other:	☐ Interconnection Amendment	☐ Publisher's Affidavit	

BEFORE
THE PUBLIC SERVICE COMMISSION OF
SOUTH CAROLINA
DOCKET NO. 2008-196-E

In Re: Combined Application of South Carolina Electric & Gas Company for a Certificate of Environmental Compatibility and Public Convenience and Necessity and for a Base Load Review Order for the Construction and Operation of a Nuclear Facility at Jenkinsville, South Carolina	)))))))	CERTIFICATE OF SERVICE

I hereby certify that on this date I served the above Surrebuttal Testimony and Exhibits of Nancy Brockway by placing copies of same in the United States Mail, first-class postage prepaid, addressed to:

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November 14 RG ~~13~~, 2008

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FRIENDS OF THE EARTH

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DOCKET NO. 2008-196-E

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SURREBUTTAL TESTIMONY
OF
NANCY BROCKWAY

FILED ON BEHALF OF INTERVENOR
FRIENDS OF THE EARTH

November 14, 2008

Q. Please state your name, affiliation and address.

A. My name is Nancy Brockway. I am the principal of NBrockway & Associates, 10 Allen Street, Boston, MA 02131.

Q. Are you the same Nancy Brockway who previously submitted testimony in this docket?

A. Yes.

Q. What is the purpose of this testimony?

A. In this testimony, I reply to statements made by Company witnesses Addison, Byrne and Lynch in their rebuttal testimony. My failure to address any particular rebuttal statement does not indicate my agreement with the point.

Q. Please summarize your surrebuttal.

A. South Carolina Electric & Gas responds to critiques of its filing in this docket as if to say that the burden is on those who question its proposal to develop alternative plans and prove they are superior to its plan. This approach to the Base Load Review Act would put customers in the position of committing billions of dollars to the Company's project on the basis of little more than the utility's say-so that the project is superior. As "trustee" in effect of the consumers' funds under the BLRA, the Commission should conduct a thorough due-diligence review of the proposal, and require the utility to show that it is proposing the best plan for its South Carolina customers.

The evidence in this docket shows that the Company has not adequately analyzed its options, nor its forecast needs and resources, particularly in light of recent developments in the economy and financial markets. Nor has SCE&G seriously considered the impacts of the current economic crisis on its proposal. By contrast, Duke has slashed its load forecast, and put off its nuclear generation plans, at least until the depth and scope of the financial crisis is resolved.

Nothing in the Company's rebuttal causes me to change my view that SEC&G would lower its risk profile if it pursed a more modular resource development program, instead of betting double its rate base on one untested technology, especially using ratepayers' money. The Commission should reject the application, or at least defer it to allow the utility to develop an integrated resources plan which accurately projects load growth, and reflects a commitment to demand-side management and alternative energy at least as determined as its current pursuit of a two-plant nuclear construction option. If the Commission determines that the project should move forward, it should so condition the utility's recovery of associated costs so that the utility is held to the promised benefits implicit in its analysis of the merits of its proposal. Such a condition is entirely consistent with the Base Load Review Act and reasonable expectations of the finance community and the Company's ratepayers as well.

Q. Please identify the points in Dr. Lynch's rebuttal testimony to which you reply in this testimony.

A. I respond below to Dr. Lynch's suggestions that SCE&G adequately considered alternatives to its two-plant nuclear option, such as renewables and demand-side management.

Q. Please identify the points in Mr. Byrnes' rebuttal testimony to which you reply in this testimony.

A. I respond below to Mr. Byrne's statements to the effect that the central station nuclear generation proposal in the Company's filing is superior because the Company has adequately considered the demand-side management option as well as the option of in-region purchases, and that the Company has properly estimated the likely schedule and cost of its proposed nuclear generation construction program.

Q. Please identify the points in Mr. Addison's rebuttal testimony to which you reply in this testimony.

A. I respond below to Mr. Addison's assertions that the current financial and economic crisis facing the nation will not adversely affect the Company's ability to raise capital for its proposed two-unit nuclear construction program, and that it will not materially affect the need for the proposed units. I respond to Mr. Addison's assertions that the utility's financial planning for the construction program is adequate to support a positive ruling under the Base Load Review Act. Finally, I respond to Mr.

Addison's suggestions that the conditions I propose for any Commission approval of the Company's proposal violate the Base Load Review Act and would prevent financing of the project on reasonable terms.

Q. Dr. Lynch in his rebuttal testimony, states that neither wind nor solar options will be viable options for SCE&G in the near future. Is his analysis sound?

A. No. Dr. Lynch continues to ignore information that supports the viability of wind and solar for South Carolina.

Q. With respect to wind power, please provide an example of the kinds of information Dr. Lynch glosses over in his rebuttal.

A. Dr. Lynch argues that there are presently no offshore wind power installations in the United States. This is true so far as it goes, but misses the larger picture. And it ignores the fact that there are no AP1000 design nuclear plants in actual service anywhere in the world.

Q. Why do you say Dr. Lynch misses the larger picture with respect to off-shore wind?

A. Dr. Lynch ignores the extensive and successful track record of off-shore wind installations in Europe, as well as the growing level of commitment to off-shore wind, worldwide and in the United States. There are presently over 1,000 mW of off-shore wind generation already in operation. Another 3,000 mW is in the planning or construction stages. Closer to home, the states of Delaware, Rhode Island and New Jersey have recently announced plans to move ahead with offshore wind as key resources in their state's generation portfolios. New Jersey's Governor has just announced plans for that state to develop 3,000 mW off the Jersey shore by 2020.

Q. With respect to solar power, please give an example of the kinds of information Dr. Lynch glosses over in his rebuttal.

A. Dr. Lynch implies, but does not say directly, that but for the state portfolio standard, Duke would not invest in its solar options in North Carolina -- he notes that Duke is subject to a renewables standard in that state. There is no reason for Dr. Lynch to dismiss Duke's initiatives in the area of renewables and other alternatives because in some states they are consistent with a state mandate.

Further, there is growing sentiment for a renewables standard ,as well as increased energy efficiency, in South Carolina. The South Carolina Climate, Energy & Commerce Advisory Committee (CECAC), a body including senior representatives of all the state's major electric utilities, among them Mr. Marsh of SCE&G, recently released its report, excerpts of which are attached as Exhibit NB-4, in which by a supermajority vote, the Committee calls for development of state "energy portfolio standards" under which 5% of retail electricity needs would be met by efficiency and 5% by renewable energy by 2020, for a total of 10%. This local interest in renewables is mirrored by growing support nationally for a commitment to obtain a significant portion of our electricity from distributed, renewable resources. For example, over two-thirds of Missourians in the most recent election supported a Clean Energy Initiative for their state, which made Missouri the 28th state to pass some form of a mandatory renewable portfolio standard. The Missouri initiative requires the state's three largest electric utilities to generate or purchase at least 15 percent of their energy from renewable sources by 2021. In addition, the campaign web-site of the President-Elect promises that the new Administration will implement a federal Renewable Portfolio Standard (RPS) to require that by 2012, 10 percent of electricity consumed in the U.S. be derived from clean, sustainable energy sources, like solar, wind and geothermal. A winning candidate's promise does not put a policy in place, but it provides some indication of the direction the country is moving in.

Q. If the Company were to implement CECAC's recommendations for South Carolina, how many megawatts of renewable energy would SCE&G be required to produce by 2020?

A. By 2020, under the Company's existing (pre-September 15) load forecast (Application, Exhibit G, p. 3 of 3), the Company's firm obligation will be 6037 mW. Five percent of this amount would be just over 300 mW. This amount in turn represents about half of the capacity the Company proposes to bring on via each of its AP1000 plants.

Q. Dr. Lynch also implies that because the Duke solar installation cost $6,000 per kW, solar is therefore uneconomic. Is his analysis

correct?

A. No. First, just knowing the per kW installation costs of any form of generation is not sufficient to assess its long run economics. One has to take into consideration the net present value of operations and capital additions costs over the forecast horizon, at least. Solar costs virtually nothing to operate. Second, the costs of solar installations continues to come down, as further research and greater commercialization of the technology continues. The United States DOE Solar Energies Technologies Program recently projected that per kW-installed costs of solar will be reduced to half of today's prices by 2015, and that this trend means solar power will be competitive with conventionally-generated power by 2010.

Q. **Turning to demand side management, both Dr. Lynch and Mr. Byrne testify on rebuttal that the Company cannot replace its proposed AP1000 generation with demand-side management. Is their reasoning sound?**

A. No. Their position is internally inconsistent, and they overly magnify limits on DSM.

Q. **In what way is the Company's position on DSM internally inconsistent?**

A. A good example of what I mean by saying the Company's position is internally inconsistent can be seen by comparing Company witness's assertions to the effect that the utility has included the maximum feasible DSM in its scenarios, with their simultaneous acknowledgment that the utility has yet to complete its ongoing consultant study of DSM potential for its region. The utility cannot know if it has included the maximum feasible DSM until it has finished its study and the study has been subjected to public review.

Q. Dr. Lynch further justifies his very conservative assumption about achievable demand-side management by arguing that California's success was driven by price response to higher electricity prices in that state, and that few utilities in the Southeast have achieved significant amounts of energy efficiency. Is his reasoning correct?

A. Dr. Lynch's reasoning here has flaws as well. As for price differentials between South Carolina and California, Dr. Lynch glosses over the fact that at the beginning of the period of energy intensity comparisons and California's diversion from the national trend, California already had higher prices than South Carolina. One would have expected that usage in earlier years would have also been suppressed, if price elasticity were the whole story. Further, Dr. Lynch ignores the fact that the Company's own price projections forecast SCE&G's retail rates being pushed up by just under 40% by the costs of the proposed AP1000 investments. This forecast does not even taken into account the likelihood of cost overruns, and it does not account for the further price increases the Company will seek to obtain a pre-completion return *of* its investment, rather than the pre-completion return *on* it that SCE&G seeks in this docket. If retail price is as powerful a motivator of customer efficiency as Dr. Lynch suggests, then it is important to consider the likely impact on demand of the rate increase needed to cover depreciation of the plant balances. As in the 1970s and 1980s, the Company (and its ratepayers and Commission) could end up paying for a plant that is no longer cost-effective because the very cost of the plant has deferred resource needs. Finally, with respect to the relatively modest levels of DSM achieved by utilities in the Southeast, per the Form 861-A data, Dr. Lynch does not note that utilities in the Southeast have not historically invested heavily in efficiency, and their DSM offerings, like those of SCE&G, do not tend to address the market barriers that effective DSM programs are designed to overcome. There is great room for superior performance in the future.

Q. What is the significance of the difference between demand response and energy efficiency, within DSM initiatives?

A. As Dr. Lynch highlights in his rebuttal, the term demand-side management or DSM includes two concepts that can and should be distinguished. "Demand response" refers to reduction in instantaneous loads at peak times, or capacity requirements (kW). The utility's interruptible rates are examples of demand response efforts. "Energy efficiency" is the other aspect of DSM, and refers to the reduction in usage (kWh) made possible by energy-saving measures such as higher-efficiency air conditioners. Energy efficiency typically includes savings at peak hours, and these peak savings have a value as demand response as well. By contrast, demand response typically only helps address peak load requirements, not baseload needs. [Note that the economic term "demand", as used in my direct testimony at p. 20, can be confused (as Dr. Lynch has evidently done) with the concept of peak demand. When used as an economic term, as in my direct testimony, "demand" can refer to "demand" for capacity, or to "demand" for energy.] In any event, the Company cites its demand response efforts as if they could substitute for energy efficiency in its planning and scenario building. If the Company indeed requires baseload generation, as it asserts, it will get more value from its DSM initiatives if it includes significant energy efficiency.

Q. Dr. Lynch claims that DSM energy contributions are hard to measure and thus robust forecasts of DSM effects cannot be relied on. Is he correct?

A. No. Dr. Lynch is repeating some of the tired old arguments that I remember hearing when I first worked in the field of regulatory demand-side management years ago. Utilities routinely argued that they could not measure DSM with sufficient precision to include its effects in their load forecasts, or use such estimates as a basis for portfolio decisions. This argument may have had some merit 30 years ago, but it is completely discredited today. In the last quarter century, hundreds of double-blind, controlled evaluations of efficiency results from DSM activities have been conducted. The methodologies for evaluating the results of DSM programs have been carefully developed by analysts. Standard protocols for determining results are in use around the United States (and indeed, around the world). Estimating the likely effects on load forecasts of various DSM initiatives is as reliable as any other element of the utility's load forecast. Utilities today include DSM estimates as a matter of course in their planning. As I will discuss further below, the forecast cost and schedule of the proposed AP1000 plants is subject to at least as much uncertainty, if not more. And the utility can respond to errors in forecasts of DSM potential by adjusting its plans, whereas a commitment to a several-billion nuclear plant cannot be unwound without considerable loss, loss that would likely be borne by the ratepayers under the statute.

Q. Are there further reasons to conclude that the possibility for demand side management as a substitute for the proposed central station generation plants are greater than assumed by Dr. Lynch and Mr. Byrne?

A. Yes. Recall that CECAC has called on South Carolina to implement an energy efficiency standard of 5% by 2020. If SCE&G were to meet such a standard, it would reduce its requirements significantly by 2016, and even more by 2019.

Q. If DSM were to reduce baseload requirements consistent with a 5% by 2020 standard, would that *alone* be sufficient to avoid the need for new plant such as that proposed by the Company?

A. Almost certainly not. But again, that is not the test. Here, as in the case of renewables, Dr. Lynch and Mr. Byrne testify on rebuttal as if each alternative, whether renewables, DSM or power purchases, must be able by itself to satisfy all the reasonably forecast needs for new resources over the planning horizon. It is this concept to which I referred in calling the Company's arguments on DSM and renewables straw men. My direct testimony was clear, and common sense dictates, that the question is instead whether there are reasonable alternative scenarios, involving various combinations of such alternatives that taken together can supply the capacity and energy needed to serve the Company's customers, and at competitive prices with less risk.

Q. Can you illustrate the alternative scenario concept you propose, by contrast with the Company's implicit insistence that each alternative by itself produce the needed resources?

A. Yes. Continuing with the consideration of the CECAC recommendations, if one were to combine at 5% efficiency goal and a 5% renewables goal for the 2020 time period, and one assumed a continuation of power purchases at the level the Company assumes for the year before its first proposed generating plant comes on line, the Company could by this combination of factors achieve a reserve margin in the same area as its target in this docket, even if demand is not reduced by the ongoing economic downturn.

Q: Would the 5% ee reduction have to be on peak?

A. No. The Company could use the 5% reduction to address its resource needs for other periods as well. As I note, the Company argues that its primary need is for baseload resources. I use the reserve margin example as a shortcut to make the point that a 5% reduction would be a significant contribution to the Company's resource requirements.

Q. In your example, you refer to the CECAC proposal. This proposal includes a goal that by 2020 at least 6% of the total electricity in South Carolina will be from new nuclear energy. Doesn't this part of the CECAC proposal show that SCE&G itself needs to add nuclear power?

A. No. Even if the CECAC proposal were adopted, it would not make sense to ask each utility in South Carolina to add nuclear power equal to 6% of its 2020 requirements. For SCE&G, 6% would represent around 350 mW. Nuclear power today can only be implemented through large central stations, so under this view of the CECAC proposal SCE&G would have to build a large plant and sell most of the output. This makes no sense for a utility of SCE&G's size. South Carolina could implement the CECAC recommendations without requiring SCE&G to build a 350 mW nuclear plant.

Q. Mr. Byrne argues that there is no "extra" generation in the region which it could purchase in lieu of generation it built and operated itself. Is Mr. Byrne's argument convincing?

A. No. Mr. Byrne does not address the possibility that others in the region who are developing large central stations may wish to sell some of the output. For example, although its Lee nuclear plant plans are on hold, Duke has expressed an interest in selling some of the output if that project is completed. I am told that, at the hearing in North Carolina on Duke's proposed contract for sales to Orangeburg (North Carolina Utility Commission Docket No. E-7, Sub 858, November 5, 2008), Duke Energy Corporation's Vice President of Business Development & Origination, Mark A. Svercek, testified that in addition to Orangeburg and Greenwood, Duke is in serious discussion with seven other entities outside of its service area for off-system sales to them. Contrary to Mr. Byrne's testimony, then, at least Duke appears to be pursuing power sales and might be able to supply power to SCE&G on favorable terms.

Q. Mr. Byrne further argues that, all things equal, it is better for SCE&G to own its own generation. Does this preference supply a basis for building two new nuclear generating plants?

A. No. Again, reading the utility's arguments on this ownership preference, I am having eerie sensations of "déjà vu" dating back almost 30 years. At that time, electric utilities across the country insisted that their loads were growing fast, and that the only alternative was for them to build, or at least participate as a joint owner in, new central station (mostly nuclear) power plants. As with utility refusals to count DSM as a resource, utility preference for ownership in the 1970s and 1980s did not translate to the desired greater certainty or control on the part of the utility. What had worked when plants were relatively smaller and more modular no longer worked when the central station play represented a huge portion of the utility's rate base. In the case of nuclear plants in particular, the untested and changing design requirements of the plants led to costly delays and burgeoning costs. The result was an erosion of earnings quality or higher rates, or both, given the magnitude of the investments relative to the existing rate base. (Ironically, rate increases achieved to help pay for these investments in turn dampened demand, making the investments that much less cost-effective). Some utilities lost control of their destinies to the federal bankruptcy court. One of these was Public Service of New Hampshire, with which I am quite familiar. A relatively small utility, and determined to own its own power plant, PSNH bet the company on its Seabrook nuclear station. When other joint owners were trying to shed their commitments to the plant, to limit their exposure to the out-of-control costs of the plant, PSNH bought additional shares in an effort to keep the project alive, rather than turn its back on the Seabrook I project. Seabrook

Station I did come on line, but as a result of its choice of technology and preference for ownership, PSNH ultimately filed for bankruptcy and was bought up by a larger utility. Meanwhile, New Hampshire was saddled with the highest rates in New England for many years. The high costs of the unfortunate nuclear investments were a major contributor to the push for restructuring of the industry in New England and California.

Q. Mr. Byrne argues in rebuttal that this scenario of costs getting out of control will not happen in the case of SCE&G for a number of reasons. First, he notes that the SCE&G proposal reflects "a superior construction site geologically; the benefit of having rail, electric transmission, nuclear security, administrative facilities, water supplies and other infrastructure already in place on that site." What is the significance of these aspects of the SCE&G proposal?

A. The geology of the site, the presence of rail and transmission facilities, and similar aspects of the site proposed by SCE&G are not the key considerations SCE&G should address when attempting to assess the risk of cost overruns. (I discuss the major uncertainties below). Citing this laundry list is a red herring. While there have indeed been sites that proved disastrous, such as the site sitting on a known earthquake fault line, the kinds of factors that put the SCE&G plant budget at great risk of upward revision will exist for the proposed plants, despite the apparently positive siting factors Mr. Byrne recites.

Q. Mr. Byrne also dismisses the risk of major cost overruns because the contract SCE&G has negotiated with Westinghouse/Stone & Webster limits cost increases, and reflects concessions by the builders for which SCE&G fought hard. Is Mr. Byrne's argument convincing?

A. No. SCE&G acknowledges that under the design/build contract, significant elements of the cost of the plant remain subject to increases out of SCE&G's control. Only some of these cost factors are subject to indexes that could limit the extent of cost increase that can be passed through under the contract. Duke, a considerably larger and more sophisticated utility, has just doubled its cost estimate for construction of the Lee station project, to $11 billion. If Westinghouse/Stone & Webster agreed to a contract that would not permit it to recover most of its costs in the event the budget had to double, it is unlikely that the contract would, in the end, protect SCE&G from the risk that the designer/builder would simply walk away and limit its exposure (or what might be worse, continue the project but cut corners to keep costs down).

Q. Mr. Byrne similarly testifies on rebuttal that the schedule for the project is reasonable. He presents several reasons for this view. First, what is your analysis of his argument that the construction schedule contained in the SCE&G Application is based on a fully developed construction plan?

A. Whatever else can be observed about the "fully developed construction plan" to which Mr. Byrne refers, it must be noted that the construction plan assumes a particular design for the AP1000. However, the design is not even set, meaning the construction plan may well have to be modified. The Nuclear Regulatory Commission, as I indicated in my Direct Testimony, has not completed its consideration of the design for the AP1000. Similarly, it is true that, as Mr. Byrne testifies, the AP1000 units are design-certified by the NRC though Revision 15. However, there are good reasons to be concerned that the changes in the design reflected in later revisions will not be approved in time to meet the construction schedule contained in the EPC Contract. Revision 16, still under review at the NRC, includes the following adjustments that must be considered, according to the Nuclear Regulatory Commission:

> a redesign of the pressurizer, a revision to the seismic analysis to allow an AP1000 reactor to be constructed on site with rock and soil conditions other than the hard rock conditions certified in the AP1000 DCR, changes to the instrumentation and control (I&C) systems, a redesign of the fuel racks, and a revision of the reactor fuel design. Another area requiring significant resources will be the review of DAC-related items, such as the technical reports on human factors engineering (HFE), the I&C design, and piping.[1]

As of September 22, 2008, the NRC had not come close to finishing its consideration of Revision 16, when the AP1000 proponents filed Revision 17, along with numerous response to Technical Reports. Revision 17 and

[1] http://www.nrc.gov/reactors/new-reactors/design-cert/amended-ap1000.html

the Technical Report proposals add yet more issues to be resolved by the NRC. Whether or not these revisions would each be necessary in the case of the SCE&G proposal, the need for the designers to obtain NRC approval of these items must be met before SCE&G's contractors can finish designing their AP1000. Only then can they fully develop a construction schedule.

Q. Does the NRC have a schedule for completing its review of the AP1000 design?

A. No. The original NRC schedule called for completion of the design review by March 2010, but it is now clear that this schedule will not be met. The schedule for NRC consideration of the AP1000 design, including the recent revisions filed by proponents, is under review by the Commission.

Q. Mr. Byrne claims that four AP1000 units are "under construction as we speak" in China. Is this an accurate characterization of the AP1000 activities in that country?

A. No. Based on press reports and reports from Westinghouse itself, it appears that China has not yet started construction of any AP1000 reactors, contrary to Mr. Byrne's claims. Rather, preparations are underway; an actual start of construction is not to begin until 2009.

Q. Mr. Byrne also argues in rebuttal that Westinghouse's parent corporation has recent nuclear construction experience in Asia,

including advanced reactors that it has constructed in as few as 39 months, and will transfer to Westinghouse/Stone & Webster the techniques it used to optimize the schedule for construction of these units. Do these facts indicate that the SCE&G AP1000 schedule can be maintained, as claimed by Mr. Byrne?

A. No. Mr. Byrne does not specify the design of the reactors Toshiba built in Asia. The reactors Mr. Byrne references are of a completely different design from the AP1000, such as the 1350 mWe Kashiwazaki-Kariwa Unit 6 Advanced Boiling Water Reactor built by Toshiba for Tokyo Electric Power Co. in 1996.[2] Such construction experience is of little value in anticipating the probabilities that Westinghouse can maintain the proposed schedule for building an AP1000, which has not yet been completed anywhere in the world.

Q. Mr. Byrne argues that the problems encountered in the construction cycle 30-40 years ago are not relevant given today's computer-assisted design, three-dimensional modeling of power plants, modular construction and design standardization. Is Mr. Byrne's conclusion sound?

A. No. While technological advances have solved some problems in the construction of large complex machines like nuclear power plants, and modular construction of standard designs may at some point mature and

[2] See, for example, http://www.toshiba.co.jp/nuclearenergy/english/business/scope/kashiwazaki6.htm

provide a basis for rapid plant construction on relatively solid schedules, the nuclear industry remains exposed to many of the contingencies that delayed nuclear plant construction in the 1970s and 1980s.

Q. What was the main problem that led the nuclear industry in the 1970s and 1980s to experience schedule delays, and cost overruns?

A. The main problem facing the nuclear construction industry in the 1970s was the rapid change of design requirements, in turn requiring costly redesigns and retrofits for plants planned or under construction. Great efforts are underway today to achieve design standardization, on which construction efficiency and certainty could be based. Nuclear plants are among the most complicated machines constructed by man, and they have the added complication of presenting unique safety and security problems. It is not surprising that the industry has not yet achieved its goal of standardization and modular construction of a new generation of plants. The industry may sensibly wait on the beginning of construction until all the design issues are resolved and a standard design has been approved. The fact that the AP1000 design is not approved and the absence of a schedule for NRC approval make the SCE&G contract schedule unrealistic by definition. Further, the NRC may not follow through with its present intention to combine the operating license and the design approval. Such a policy shift might speed the start of construction, but it would open the door to the erosion of the standardization objective, increasing the risk that the plants would be subject to retrofits and other budget-busting delays. But perhaps more importantly, SCE&G is too small a utility to take on the task of pioneering what may evolve into a standard design. The first attempts at construction inevitably bring to light issues that the most sophisticated design process did not anticipate. SCE&G places itself and its customers at great risk by pushing to be one of the first to build two new nuclear plants using the as-yet-unfinished AP1000 design.

Q. Mr. Byrne in rebuttal argues that the Commission should not be concerned with the risk of schedule delays because the design/build contract includes a liquidated damages clause under which SCE&G would be paid if Westinghouse/Stone & Webster missed deadlines for construction. Does the presence of a liquidated damages clause ensure that the plant would be built on or close to its current schedule?

A. No. In the case of a project of such size and inherent uncertainty, the presence of a liquidated damages clause, in and of itself, is not enough to ensure that the designer/builder will bring the plant on line at the budgeted level. Unforeseen events could require changes in the design or construction the costs of which could easily outweigh the liquidated damages protection. For example, even before Duke has begun construction of its Lee plant, its cost estimate has recently doubled. It is hard to imagine a liquidated damages clause to which the designer/builders would agree that would be sufficient to hold them to a contract that pays them only about half of the cost of the project.

Q. Please turn to the rebuttal testimony of Mr. Addison. What are the main arguments Mr. Addison presents?

A. Mr. Addison would have the Commission believe that the Company can still raise capital for its nuclear construction plans despite the current economic crisis, that the economic downturn will not affect need for the plant, and that my proposed alternatives for conditioning any approval violate the Base Load Review Act and prevent financing on reasonable terms.

Q. On what basis does Mr. Addison dismiss concerns about financing in the face of the current economic crisis?

A. Mr. Addison lumps the current economic crisis with the ordinary ebbs and flows of the business cycle. He also points to the utility's recent financings as evidence that the economic crisis has not adversely affected the Company.

Q. Do Mr. Addison's arguments set to rest doubts about the ability of SCE&G to finance its ambitious nuclear generation program on reasonable terms?

A. No. The current economic crisis is different in scale and scope from the ordinary ebbs and flows of business activity, and a distribution utility's ability to raise limited funds to provide short-term liquidity is no gauge of whether it can obtain several billions of dollars to build two proposed nuclear power plants.

Q. Please briefly describe the current economic crisis and its impacts on corporate financing.

A. The United States, and indeed, the entire world, remains in the grip of a financial and economic crisis that started earlier this year but came to a head in mid-September. In addition to distress in numerous banks and financial institution, the "real" economy is seeing large numbers of bankruptcies or near bankruptcies. Despite a promised infusion of almost $700 billion into the financial sector, as of this writing financing for business needs has become difficult to obtain and expensive. It is not clear how deep or long the downturn will be.

Q. But Mr. Addison points to the Company's recent issuance of $300 million in ten-year debt to cover corporate expenses, and its $400 million draw on credit lines, all since the financial meltdown. Do these events not demonstrate the validity of his "flight to quality" argument?

A. No. First, as Mr. Addison explained in the SCANA third quarter earnings conference call with investors and analysts October 31, 2008, the Company took advantage of a "window of opportunity" and sought the additional funds from the first mortgage debt issuance and the credit line draw as defensive measures. These were not routine borrowings as Mr. Addison suggests in his Rebuttal, but rather were intended to shore up liquidity and protect against the risk that credit markets would continue to be hard for SCE&G to access. Mr. Addison could not reassure the investment community that similar funds would continue to be available on reasonable terms through 2009. The two financings Mr. Addison discusses were not evidence of business as usual, and do not indicate that the Company will continue to have ready access to financing.

Second, this docket should not turn on whether the ongoing operation of SCE&G will likely continue to kick out revenues sufficient to support repayment of the two relatively modest financings to which Mr. Addison refers. The ongoing operation of the utility is one thing, and a several billion dollar program to construct new nuclear power plants (at a cost twice the utility's rate base) is another. As recently as the end of September, Fitch ratings gave the Company a "Negative Outlook" due to "substantial financial commitment of its plan to construct two nuclear generating units for service in 2016 and 2019, respectively as well as the construction risk and uncertainties associated with a project of this size and complexity." Mr. Addison brushed aside these warnings in his Direct testimony, but the financial and economic crises if anything give them more meaning today.

Q. Mr. Addison tries to reassure the Commission that the present

financial crisis is simply part of the ordinary ebb and flow of business fortunes, and that over the long run, events will justify a decision made today to invest billions of dollars in two new nuclear power plants. Do you agree?

A. No. Even Mr. Addison recognizes (Rebuttal at p. 4, line 6) that the present financial crisis is the worst in the last 75 years. Further, other utilities have reacted with more caution and discretion to the current crisis and the prospect of continued difficulties in the economy. For example, Duke (a much larger firm) recently announced that it is deferring for up to a year its planned filing with the South Carolina Commission for approval of the Lee nuclear power plant, to reassess forecast energy demands as well as the plant's costs.

Q. Has Duke taken other steps to reflect the economic downturn in its long-range planning?

A. Yes. Duke has already cut its annual growth projections for energy sales in the Carolinas by 28.4% over the next 16 years. If SCE&G forecast were to be reduced by the same amount, simply on account of the economic slowdown, incremental requirements for the years in which SCE&G plans to add its new AP1000 plants might be down by as much as a quarter from the present forecast.

Q. Does the fact that Duke has revised its forecast downward mean that SCE&G's retention of its pre-crisis forecast is wrong?

A. The fact that Duke has revised its long-term Carolinas forecast in light of the financial crisis indicates that SCE&G should at the least conduct sensitivity analyses examining the implications of a similar reduction in future energy requirements. It is not enough for SCE&G simply to argue that the Commission need not be concerned about such a possibility. Deferral of energy demand could push out the timing of a cost-effective addition of new plant, regardless of the assumed costs.

Q. Doesn't the economic downturn suggest that the cost of the two proposed central station nuclear plants will moderate?

A. Some drivers of the cost of the plants may contribute to moderating construction cost increases as the economic downturn persists. Others will not. Recall that Duke in its November 3, 2008 revised IRP filing with the Commission doubled its estimated cost for construction of the two Lee nuclear plants in Gaffney to $11 billion, from the original $4 - $6 billion estimate. Duke's revised estimate is as much as $3 billion higher than its December 2007 estimate. This estimate is only for so-called "overnight" costs. Adding the carrying costs of the project over its construction period would add another $5 billion or so to the total. While some of the escalation relates to expenses not directly relevant to the SCE&G situation, other components include increases in equipment and commodity costs. The ultimate cost of new nuclear power plants cannot be estimated with certainty, but one can say with confidence that cost estimates are susceptible to sharp upward revision.

Q. Mr. Addison expresses surprise that you would imagine SCE&G was seeking federal loan guarantees to help support its nuclear program. Why would you think SCE&G was looking for federal support for its program?

A. SCE&G has stated that it began looking at the nuclear option seriously when the Energy Policy Act of 2005 passed, indicating government support for new nuclear power. A key feature of that statute is the nuclear construction loan guarantee. SCE&G has not denied press coverage suggesting that the firm has applied for federal loan guarantees. SCE&G should at least clarify if it has applied to the DOE for a loan guarantee under the existing $18 billion program. If so, the Company should state where it ranked in the "initial rankings" about which DOE notified applicants at the end of October (that is, into which "bucket" did SCE&G get placed?). Part II loan guarantee submissions in the program are due to DOE by December 19, 2008. SCE&G should clarify whether it will participate or not in this next round, as well, before the Commission attempts to sort out the risks that would remain to be borne by South Carolina ratepayers.

Q. Mr. Addison argues that your proposed conditions on any approval of the Company's proposed nuclear construction plan contradict the terms of the Base Load Review Act as he understands them and as

they have been presented to, and understood by, the investment community. Do you agree?

A. I would note first that the consumers cannot be held responsible for the Company's representations to the investment community regarding the meaning of the Base Load Review Act. If the Company has given Wall Street the impression that the Commission can impose no conditions on its BLRA approvals, that approvals are a foregone conclusion, and that the Company does not bear a heavy burden of demonstrating the superiority of its plan, and further if Wall Street believed such representations, what is needed is a clarification of the statute. Having said that, and referring merely to a plain language reading of the Act, I do not agree. I presume the legislature used common sense in developing the Act. Given this presumption, I assume the legislature did not intend to create a situation that either exposed consumers to unreasonable and one-sided risks, nor impeded the development of nuclear power in South Carolina. The Company's interpretation of the Act would produce one or the other of these effects.

Q.` Why do you say that Mr. Addison's understanding of the Act would leave the Commission in a position where it either had to subject consumers to unreasonable risks or impede the development of nuclear power in South Carolina?

A. We are presently at a stage in the development of nuclear power in this country where many key design and construction issues remain to be resolved. It also happens that the Company is bringing forth its proposal for a massive nuclear plant investment at a time when economic conditions are roiling at best, and may settle into a long-term downturn, which undermines earlier projections of the need for and timing of new resources, as Duke has recognized. This is an extremely risky time for any utility, much less a relatively small local utility, to bet all its resources on one option, the new nuclear path. Further, if the Company pursues this capital-intensive option, it will preclude the pursuit of more modular options that also have risks, but that would not cause irreversible harm if those risks came to pass. Tying up all available capital in the central-station generation option would also make it difficult to comply with legal mandates for efficiency and renewables that may come to be required. These efficiency and renewable options may need development over the years, but they have the benefit of being modular. If one or more of them does not pan out, the Company will be able to change course without having bet twice its capitalization on any single one of them. A prudent Company would hold off on such a commitment and pursue other options more vigorously. A prudent Commission would require nothing less.

Q. What is the role of the Commission in reviewing this BLRA proposal?

A. The Commission is a trustee of the ratepayers' money, in effect. The

Commission must ensure that the "deal" being presented does not subject the ratepayers to unreasonable risks. The Company wishes to transfer the net risks of the all-nuclear option to the consumer through its interpretation of the Act. However, the best the consumer can hope from the success of this path is reliable power at the cost of construction and operation. The upside opportunity for the consumer is limited, and consumers have no claim on the remaining assets of the Company if the bet fails. The consumer is being asked to take the downside risk, in the Company's interpretation of the Act, and thus to be in the position of a financier for the project. But the terms of the Act as the Company would have it interpreted would leave the consumer with no contractual rights to repayment of this financing, nor to sharing with the utility profits that might be achieved if the project risks do not materialize.

Q. But how does this view of the Act's allocation of risk and reward translate to a tendency on the part of the ratepayer's surrogate, the Commission, to impede such projects?

A. To the extent the Act asks the Commission to put these extraordinary risks on the consumer without conditions to moderate the risks and share them with the utility, it raises the bar for Commission approval of these options. If the Company thinks the Act allows it to offer a pro forma justification for its proposal, and then require the Commission to transfer the risks over to the Consumer, it will not be motivated to give the same attention and care to its choice as it would were it actually betting its own money. We have seen recently what mischief occurs when firms place speculative bets with "OPM" – Other People's Money. That is what SCE&G asks the Commission to allow it to do. But, given the great risks of the all-or-nothing new nuclear path, especially at this early stage in development of new nuclear options and in light of the uncertainty of the economy, a prudent "trustee" of the consumers would reject the option altogether. Indeed, this is what I recommend that the Commission do.

Q. South Carolina has a long tradition of support for nuclear power. Wouldn't a rejection of the Company's proposed rate treatment under the BLRA indicate a retreat from such support?

A. Not at all. Such a rejection would be without prejudice to the firm returning when the economic future is somewhat easier to predict, and when the significant issues with new nuclear power have been worked out, presumably by those with deeper pockets, and a deeper "bench" of expertise in nuclear matters. To ignore the realities of the situation, as the Company would have the Commission do, would be to turn the Base Load Review Act into a rubber stamp for any new nuclear scheme, rather than a useful tool for support of well-considered new nuclear projects.

Q. You began your discussion of the Company's rebuttal by saying that SCE&G holds alternatives such as renewables, efficiency and power purchases to higher standards than the AP1000 proposal of the

Company. Given your discussion of the Company's rebuttal arguments, please elaborate on this statement?

A. The Company's witnesses place little weight on the risks of the AP1000 nuclear option, but stress the risks of the efficiency and renewable options. The Company puts lots of numbers in front of the Commission, but in the end, it is asking the Commission to discount all risks of the nuclear option, and reject all other possibilities. This is a particularly risky approach for consumers, because adoption of the Company's "build two nuclear plants" option will effectively prevent the Company from investing in any of the alternatives for a generation or more. However, recalibrating its load forecast and beginning a program of intensive development of more modular options would expand the Company's range of options without requiring it to turn its back on the nuclear option for a generation.

Q. What do you conclude?

A. The Company has not satisfied the heavy burden of showing that the risks are low, manageable and proportionate to the likely benefit of its proposed plan, given the state of the industry, the state of the economy, and the potential for alternative resources that can be developed in a modular fashion without displacing the nuclear option for the future. In light of these factors the Company itself should take the prudent step of withdrawing this application. In any event the application should be rejected without prejudice, deferred until key factors are more clear, or at least conditioned so that the Company is held to its assertions regarding the costs and risks of its proposal.

Q. Does this conclude your surrebuttal testimony?

A. Yes.

Exhibit NB-4

South Carolina Climate, Energy, and Commerce Committee

Final Report

July 2008

Table of Contents

Members of the South Carolina Climate, Energy and Commerce Advisory Committee

Rep. Ben Hagood, South Carolina House of Representatives/Chairman
Dana Beach, Executive Director, South Carolina Coastal Conservation League
Crandall Close Bowles, Chairman, Springs Industries, Inc.
Jim Byrd, Deputy Director, Market Services Division, South Carolina Department of Insurance
Lonnie Carter, President and CEO, Santee Cooper
John Clark, Director, South Carolina Energy Office
Giff Daughtridge, Vice President and Division General Manager, Nucor Steel (replaced Ladd Hall who attended the first CECAC meeting)
Barry Falin, Vice President (retired), Performance Polymers Manufacturing, Eastman Chemical Company
Bob Fledderman, Manager, Environment and Regulatory Assurance, MeadWestvaco
John Frampton, Director, South Carolina Department of Natural Resources
Dr. Paul Gayes, Director, Center for Marine and Wetlands Studies, Coastal Carolina University
Emerson Gower, Vice President, Southern Region, Progress Energy Carolinas
Ladd Hall, Vice President and General Manager, Nucor Steel
Joe James, CEO, Corporation for Economic Opportunity
Bob King, Deputy Commissioner, South Carolina Department of Health and Environmental Control
Kevin Marsh, President, South Carolina Electric & Gas (replaced Bill Timmerman who attended the first CECAC meeting)
Dr. Marcus Newberry, Former Dean, Medical University of South Carolina College of Medicine
Mike Olbrich, Plant Manager, BP Chemical
James E. Rogers, Chairman, President, and CEO, Duke Energy Corporation
Bob Scott, President, South Carolina Forestry Association
Lanneau H. Siegling, Past Chairman, Hospitality Association of South Carolina
David Smalls, President, Walterboro-Colleton Chamber of Commerce
Dr. Stephen Smith, Executive Director, Southern Alliance for Clean Energy
John Tiencken, Special Counsel to the Electric Cooperatives of South Carolina
Sen. Danny Verdin, South Carolina Senate
Hugh Weathers, Commissioner, South Carolina Department of Agriculture
Johnny Williamson, CEO, South Carolina Soya, LLC
Brad Wyche, Executive Director, Upstate Forever

Appendix H
Energy Supply Sector
Policy Recommendations

Summary List of Policy Recommendations

Policy No.*	Policy	GHG Reductions ($MMtCO_2e$)			Net Present Value 2008–2020 (Million $)[1]	Cost-Effective-ness ($/tCO_2e$)[1]	Level of Support
		2012	2020	Total 2008–2020			
ES-1	Efficiency and Renewable Portfolio Standard and Statement of Support for Nuclear Energy	1.9	12.6	66.5	$689	$10	Super Majority (Three objections)
ES-1a	Energy Efficiency: 5% of energy met with energy efficiency resources by 2020	0.8	4.2	22.4	–$586	–$26	
ES-1b	Renewables: 5% of energy served by new renewable resources by 2020	1.1	3.8	25.3	489	$19	
ES-1c	Nuclear: 6% of energy served by new nuclear resources by 2020	0.0	4.6	18.9	$786	$42	
ES-2	Technology Research and Development, Including State Funding	*Not quantified*					Unanimous
ES-3	Renewable Energy Financing, Tax Incentives, Loans	0.4	0.9	7.1	$591	$84	Unanimous
ES-4	Regulatory Model To Equalize Utility Earnings on Energy Efficiency With Earnings on Traditional Power Supply	*Not quantified*					Super Majority (One objection)
ES-5	Nuclear Fuel Reprocessing	*Not quantified*					Unanimous
ES-6	Green Power Purchases and Marketing, 1% Participation by 2012	0.2	0.2	1.7	$46	$27	Unanimous
ES-7	Attract Renewable Energy Technology Businesses to South Carolina	*Not quantified*					Unanimous
ES-8	Distributed Renewable Energy Incentives and/or Barrier Removal (Including Interconnection Rules)	0.05	0.1	0.8	$42	$50	Unanimous
	Sector Total After Adjusting for Overlaps	**0.3**	**3.0**	**22.5**	**$1,201**	**$53**	
	Reductions From Recent Actions	**0.0**	**0.0**	**0.0**	**0**	**0**	
	Sector Total Plus Recent Actions	**0.3**	**3.0**	**22.5**	**$1,201**	**$53**	

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/tCO_2e$ = dollars per metric ton of carbon dioxide equivalent.

All costs are reported in 2005 U.S. dollars, net present value as of January 1, 2009. Negative values in the Net Present Value and the Cost-Effectiveness columns represent net cost savings associated with the recommendations. Totals in some columns may not add to the totals shown due to rounding.

The numbering used to denote the above policy recommendations is for reference purposes only; it does not reflect prioritization among these recommendations.

General definition: For the purposes of the policies discussed here, and unless otherwise noted, "renewable energy" is defined as follows: A renewable energy resource includes solar; wind; small hydroelectric; geothermal; ocean current or wave energy; biomass resources, including agricultural waste, animal waste, wood waste, spent pulping liquors, combustible residues, combustible liquids, combustible gases, energy crops, and landfill methane; waste heat derived from a renewable energy resource and used to produce electricity; and hydrogen derived from a renewable energy resource.

For the combined impact of all ES policies, the incentives for utility-scale renewable energy projects in ES-3 are assumed to be redundant with the renewable energy mandate in ES-1; however, the distributed energy incentives in ES-3 are found to be larger than the impact of ES-8 and ES-8 is found to have no incremental impact over ES-3. These distributed renewable energy incentives, as well as voluntary green power initiatives (ES-6) are assumed to be incremental, and not to overlap with ES-1. Further, the energy efficiency component of ES-1 is assumed to overlap with the energy efficiency policy under RCI-1, and the goals for the nuclear and renewables components of ES-1 are reduced to reflect energy savings under RCI-1.

Several Energy Supply policies rely on biomass feedstock to replace fossil-based electricity generation. Similarly, a number of AFW policies also rely on the use of biomass for both electricity production and other energy-related uses. Specifically, the biomass generation benefits in ES policies 1, 3, and 6 are found to overlap with AFW policies 2, 5, and 9. The fundamental limit that creates an overlap among these policies is the limited availability of biomass feedstock in South Carolina.

To accommodate this limit, the cumulative impact analysis for the ES sector does not include any of the electricity generation from woody biomass, swine waste, or poultry litter resulting from ES policies, and the impact of landfill gas generation has been reduced by 18%. Either this generation is already accounted for in AFW policies, or else the feedstock is used for another purpose that has a similar or greater impact in mitigating GHG emissions in the state.

ES-1. Efficiency and Renewable Portfolio Standard and Statement of Support for New Nuclear Energy

Policy Description

This policy recommends that the state develop energy portfolio standards, including renewable technologies and energy efficiency, and adopt a statement of policy supporting development of new nuclear power.

Energy efficiency includes applications that provide measurable, verifiable, long-term savings to the retail customer compared to current technology in use, including (but not limited to) appliances; lighting; heating, ventilation, and air conditioning; building envelope; and efficient motors.

The portfolio standard will consider the following implementation parameters:

- Ensure that the short-term and long-term demands for electricity in South Carolina are met without causing undue economic harm to its citizens.
- Protect and enhance the quality of the environment in South Carolina through increased use of renewable, energy efficiency, nuclear, and/or other low-greenhouse-gas (GHG)-emitting sources of energy.
- Encourage the development, construction, and operation of clean energy resources at sites in South Carolina that have the greatest economic potential.

Policy Design

Goals:

Each public or private utility generating electricity in South Carolina for sale within the state will meet at least 5% of its South Carolina retail customers' electricity needs by 2020 through energy efficiency and demand response program implementation. The state, in developing its energy efficiency and demand response policy, will minimize the cost impacts to customers, while ensuring cost recovery for utilities. The policy will allow the industrial class of customers to opt out of the energy efficiency programs if such customers have similar programs in place achieving similar goals.

Each public or private utility generating electricity in South Carolina for sale within the state will meet at least 5% of its retail customers' electricity needs by 2020 from renewable energy placed into service after December 31, 2003. These needs may be met with renewable energy placed on the utility's retail distribution system. The state, in developing this renewable policy, will minimize the cost impacts to retail customers, while ensuring cost recovery for utilities. This renewable energy requirement may be met either through physical generation with in-state renewable energy resources, or through the purchase of Renewable Energy Credits (RECs) from in-state or out-of-state sources.

It is the declared policy of South Carolina that the development of new nuclear energy is an important part of the state's future energy needs due to the reliability of nuclear energy and the substantial reduction of GHG emissions resulting from nuclear energy. Therefore, the state will produce by 2020 at least 6% of the total electricity generated in South Carolina with new nuclear energy put into service after January 1, 2008.

See "Key Assumptions" for additional detail on interpretation of goals for analytical purposes.

Implementation Mechanisms

- The General Assembly should consider amendments to the South Carolina Energy Efficiency Act, Chapter 52 of Title 48 of the South Carolina Code of Laws, to enact renewable energy and energy efficiency portfolio standards, and to adopt policies and goals supporting the development of new nuclear energy.
- Renewable requirements may only be met with resources brought on line no earlier than January 2004, subject to geographic restrictions similar to those adopted by North Carolina for its Renewable Energy and Energy Efficiency Portfolio Standard.
- Renewable resources are assumed to be brought on line in merit order—i.e., starting with the lowest-cost available resources on a levelized dollar per megawatt-hour ($/MWh) basis.
- Provision should be made to address or exempt the inclusion of the Piedmont Municipal Power Agency and other small utilities relying primarily on hydropower. Piedmont currently generates over 90% of its power from nuclear and renewable resources.
- Caps or limitations should be considered on the amount of renewable energy to be generated from woody biomass in order to avoid inappropriate interference with forest product markets. No limitation should be placed on closed-loop woody biomass, such as planting short-rotation woody fiber crops as a dedicated source for biomass fuel.
- Consumers should be protected from excessive cost impacts from this policy—e.g., by limiting the cost per MWh, the rate impact, or the total impact of ratepayers' bills. These cost-protection measures can apply to one or more components of this policy (i.e., renewable energy, energy efficiency, or nuclear resources), in aggregate or individually.
- Provisions should be made for utilities to recover all costs of demand-side management/energy efficiency and renewable energy through an annual recovery clause consistent with policy ES-4 (Regulatory Model To Equalize Utility Earnings on Energy Efficiency With Earnings on Traditional Power Supply).

Related Policies/Programs in Place

South Carolina Energy Efficiency Act, Title 48, Chapter 52.

Type(s) of GHG Reductions

Avoided emissions associated with reduced fossil-fired electricity generation.

Estimated GHG Reductions and Net Costs or Cost Savings

Table H-1 presents the estimated GHG emission reductions and the net costs of or savings from implementing each component of this policy.

Table H-1. Estimated GHG reductions and net costs of or savings from ES-1

Scenario	GHG Reductions ($MMtCO_2e$) 2012	2020	Total 2009–2020	Gross Cost (million $)	Gross Benefits (million $)	Net Present Value 2009–2020 (million $)	Cost-Effective-ness ($\$/tCO_2e$)	Net per kWh Produced in 2020 (cents/ kWh)	Net Rate Impact per SC kWh in 2020 (cents/ kWh)
Energy efficiency	0.8	4.2	22.4	$513	–$1,099	–$586	–$26.2		
Biomass	1.0	2.4	17.0	$1,116	–$857	$259	$15.2	2.1	0.065
New hydro	0.0	0.0	0.0	0.0	0.0	0.0	$36.6	4.4	0.000
Landfill gas	0.1	0.4	2.5	$126	–$128	–$2	–$0.7	0.2	0.001
Residential & commercial PV	0.0	0.0	0.0	0.0	0.0	0.0	239.0	26.7	0.000
Utility PV	0.0	0.0	0.0	0.0	0.0	0.0	$111.2	2.0	0.000
Offshore wind	0.0	1.0	5.1	$465	–$244	$221	$43.3	5.5	0.070
Onshore wind	0.0	0.1	0.6	$40	–$29	$11	$18.4	2.6	0.003
Nuclear	0.0	4.6	18.9	$1,675	–$889	$786	$41.6	5.1	0.306
Aggregate Portfolio	1.9	12.7	66.5	$3,936	–$3,247	$689	$10.4		

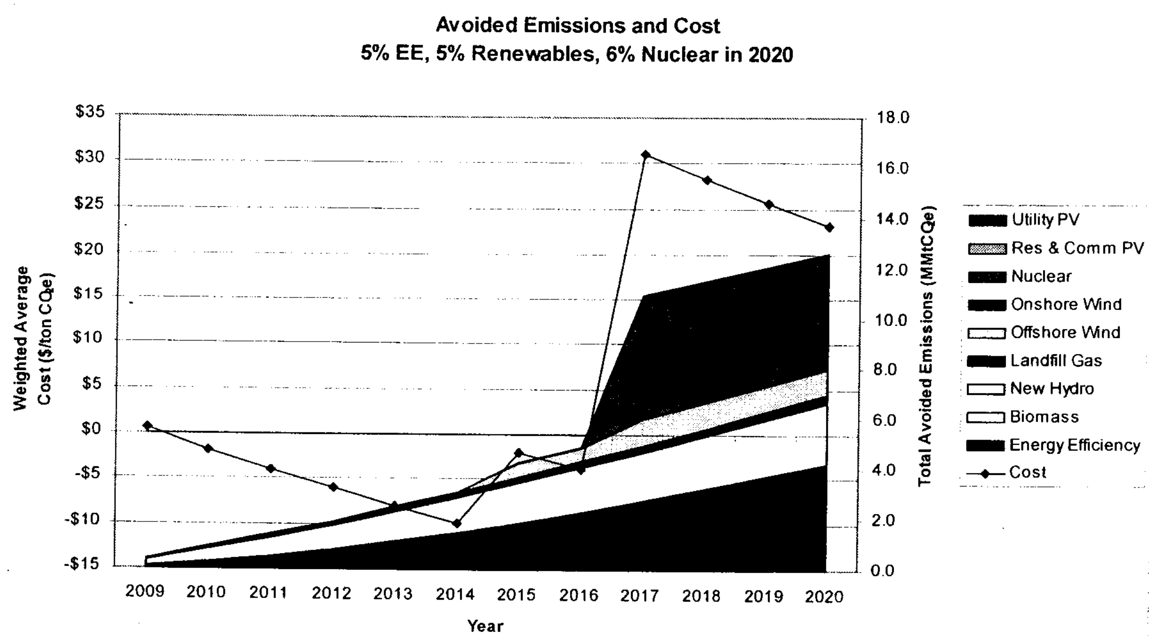
GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; kWh = kilowatt-hour; $\$/tCO_2e$ = dollars per ton of carbon dioxide equivalent; MW = megawatt; PV = photovoltaic; SC = South Carolina.

Constituent scenarios are defined as follows:

Energy efficiency	1% demand reduction per year by 2015, 1.5%/year by 2020
Biomass	491 MW by 2020
New hydro	100 MW by 2020
Landfill gas	70 MW by 2020
Residential and Commercial PV	5 MW by 2020
Utility PV	10 MW by 2020
Offshore wind	500 MW in 2015, 500 MW in 2017
Onshore wind	50 MW by 2020
Nuclear	1,000 MW in 2017

Figure H-1 shows the annual avoided emissions by component in million metric tons of carbon dioxide equivalent ($MMtCO_2e$) (right vertical axis) and the total annual cost in dollars per metric ton of carbon dioxide equivalent ($\$/tCO_2e$) (left vertical axis) for the aggregate scenario.

Figure H-1. Annual avoided emissions by component and total annual cost



EE= energy efficiency; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/$tCO_2e$ = dollars per ton of carbon dioxide equivalent.

Data Sources:

Cost of Power Plants

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Quantification Methods:

- Determine the resource mix consistent with the policy goal and least-cost renewables ramped in over each year through 2020.

- Determine the costs of each resource and the aggregate cost each year based on the resource mix.
- Estimate the annualized costs, avoided electricity costs, and avoided emission benefits of the policy.

Key Assumptions:

Basis of Analyzed Composite Portfolio Structure

The 5% energy efficiency, 5% renewable energy, 6% new nuclear clean energy portfolio supports investment in energy efficiency and renewable energy while considering and balancing the cost impacts to electricity customers and the requirement to provide South Carolina citizens with safe, reliable, cost-effective electricity.

Avoided Costs

The avoided cost of electricity at the generator bus in South Carolina is $55.75 per megawatt-hour (MWh).

Operational and Economic Resource Parameters

- For purposes of analysis only, we assume the following renewable resource potentials:
  - 100 megawatts (MW) of small hydro;
  - 50 MW of onshore wind;
  - 1,000 MW of offshore wind (two 500-MW projects installed in 2015 and 2017, respectively);
  - Biomass total potential based on "practical potential" from the 2007 GDA/La Capra study, split evenly between co-firing and direct firing, or a total of 491 MW statewide by 2020;
  - 15 MW of photovoltaic (PV) potential by 2020; and
  - Efficiency and nuclear resource components were assumed not to be constrained by resource availability.
- For the percentage-based renewable energy goals, resources are included in increasing order by resource cost.
- Costs to be analyzed on a dollar per kilowatt-hour ($/kWh) basis, as well as dollar per metric ton of carbon dioxide equivalent ($/tCO$_2$e) avoided.
- Pre-2015 eligible resources are assumed to receive a production tax credit (PTC) throughout the period. The federal investment tax credit (ITC) for solar is assumed to be 30% until 2012, decreasing to 15% by 2020.
- Biomass co-firing projects receive a PTC of 1 cent/kWh, and other biomass projects receive a PTC of 1.5 cents/kWh.
- The economic and operational assumptions for renewable energy resources used in the analysis are summarized in Table H-2; the economic parameters used for new nuclear power plants are summarized in Table H-3.

Table H-2. Economic and operational assumptions for renewable energy resources

Renewable Technologies	Typical Size (MW)	Capacity Factors	Average Installed Cost (2006$/kW)	High Installed Cost (2006$/kW)	Fixed O&M (2006$/kW)	Variable O&M (2006$/MWh)	Heat Rate (Btu/kWh)
Landfill gas ICE (> 5 MW)[1]	5–10	80%–85%	$1,750	$2,000	$100	$12	9,500
Landfill gas ICE (< 5 MW)[1]	1–5	80%–85%	$2,500	$3,000	$100	$12	9,500
Biomass (co-fire blending)[2,3,5]	5% of host capacity	70%–75%	$75	$100	$12	$5	12,000
Biomass (co-fire retrofit)[2,4,5]	15%–20% of host capacity	70%–75%	$230	$300	$12	$5	12,000
Biomass (stoker)[5]	25	80%–90%	$2,700	$2,970	$75	$10	13,000
Biomass (fluidized bed)[5]	25	80%–90%	$3,000	$3,300	$75	$10	13,800
Anaerobic Digester (swine waste)	0.1	70%–80%	$4,000	$6,000	$270	$0	14,000
Wind (onshore)	25–50	25%–28%	$1,800	$2,000	$45	$2	
Wind (offshore)	50–400	30%–35%	$2,800	$3,300	$80	$2	
Hydropower (conventional)	1–50	25%–35%	$2,000	$3,500	$12	$3	
Hydropower (small hydro)	1–30*	25%-35%	$3,000	$4,000	$20	$5	
Hydropower (low head)	< 1*	20%–35%	$4,000	$5,000	$50	$10	
Solar PV (utility scale)	1–10	19%–21%	$4,000	$5,000	$15		
Solar PV (commercial)	0.025–0.050	19%–21%	$6,000	$8,000	$30		
Solar PV (residential)	0.002	19%–21%	$8,000	$10,000	$50		

Btu = British thermal unit; ICE = internal combustion engine; kW = kilowatt; kWh = kilowatt-hour; MW = megawatt; MWh = megawatt-hour; O&M = operation and maintenance; PV = photovoltaic.

Source: GDS Associates, Inc., and La Capra Associates, Inc. "Analysis of Renewable Energy Potential in South Carolina: Renewable Resource Potential—Final Report." Prepared for Central Electric Power Cooperative, Inc. September 12, 2007. Available at: http://www.ecsc.org/newsroom/RenewablesStudy.ppt.

Note: Capital costs for landfill gas, biomass, and hydropower are reduced over time following U.S. Department of Energy (DOE), Energy Information Administration (EIA) 2007 trends analysis in AEO 2007. Fuel cell capital costs are assumed to decrease consistent with GRI and NREL 2003. The capital cost for PV is a TWG assumption. No cost decrease is assumed for wind and nuclear technologies.

Notes:

1. The fuel cost range for landfill gas projects is assumed to be $0.50–$1.50/MMBtu [2006$]).

2. Co-firing costs are calculated as incremental costs of avoiding coal consumption for generation ($2.25/MMBtu [2006$] coal cost assumed). No additional avoided costs are assumed for this resource.

3. Blending refers to retrofitting coal plants with the ability to blend some biomass (up to 5% of fuel consumption of site) with coal fuel.

4. Retrofit refers to greater capital improvements needed to accommodate higher levels of biomass co-firing (15%–20% of fuel consumption of site) with coal.

5. The biomass fuel cost range is assumed to be $1.88–$3.90/MMBtu (2006$).

* The size of hydro facilities is measured in MWh, based on annual average flow, rather than nameplate capacity.

Table H-3. Summary of economic parameters for nuclear resources

Nuclear Power Cost Assumptions			
Parameter	**Value**	**Units**	**Source**
Installed cost	$5,700	$/kW	Moody's
Capacity factor	90%		Moody's
"To-Go" costs*	$5.5	$/MWh	Moody's
Variable O&M cost	$12.5	$/MWh	Moody's
Fixed O&M cost	$110	$/kW-yr	Morris et al.
Fuel	$15	$/MWh	Morris et al.

O&M = operation and maintenance; kWh = kilowatt-hour; kW-yr = kilowatt-year; MWH = megawatt-hour

*Incremental capital costs, administrative and general costs, insurance costs, and other fees.

Cost of Energy Efficiency Measures or Saved Electricity

The cost of saved energy is assumed to be $0.03/kWh, following Residential, Commercial, and Industrial (RCI) Technical Work Group (TWG) analysis of policy RCI-1.

For other states, see Table H-4.

Table H-4. Cost of energy efficiency measures or saved electricity for other states

State/Utility	CSE ($/kWh)	Program Year	Source
Western Utilities	0.025	1978-2004	Energy Efficiency Task Force 2006[1]
Northwest Energy	0.02	2006	Montana PSC Docket No.: D2005.5.88 07/12/06
New York	0.03	2004	Heschong Mahone Group, Inc. 2005
Massachusetts IOUs	0.038	2002	Fry 2003
California	0.03	N/A	Kushler et al. 2004
Connecticut	0.023	N/A	Kushler et al. 2004
New Jersey	0.03	N/A	Kushler et al. 2004
Vermont	0.03	N/A	Kushler et al. 2004

IOUs = investor-owned utilities; $/kWh = dollars per kilowatt-hour; N/A = not applicable; PSC = Public Service Commission.

Efficiency Measure Lifetime/Amortization Period: 13 years on average, no attrition during lifetime.

Zero-or Low-Carbon Resource Supply Curve

The levelized cost of electricity (LCOE, measured in lifetime $/MWh) of each resource can be calculated using a financial model, leading to a supply curve for reducing carbon emissions by displacing conventional generation with zero- or low-carbon emission energy sources (including energy efficiency.) The financial model parameters are as shown in Table H-5.

[1] Energy Efficiency Task Force. *The Potential for More Efficient Electricity Use in the Western United States*, Report to the Clean and Diversified Energy Advisory Committee of the Western Governors' Association, Denver, CO: Western Governors' Association, January 2006. Available at: http://www.westgov./wga/initiatives//%20Efficiency-full.pdf

Table H-5. Financial model parameters and costs for energy resources

Renewable Technologies	LCOE (2005$/ MWh)	Average Capacity factor	Installed Cost (2005$/ kW)	Fixed O&M (2005$/ kW/yr)	Variable O&M (2005$/ MWh)	Fuel Cost (2005$/ MWh)	WACC*	Tax Credit	Economic Life	CRF	Source
Landfill gas ICE (> 5 MW)	$58	83%	$1,701	$97.2	$11.7	$9.5	8.5%	0%	20	9.7%	GDS 2007
Landfill gas ICE (< 5 MW)	$67	83%	$2,430	$97.2	$11.7	$9.5	8.5%	0%	20	9.7%	GDS 2007
Biomass (co-fire Blending)**	$15	73%	$73	$11.7	$4.9	$7.7	8.5%	0%	20	9.7%	GDS 2007
Biomass (co-fire Retrofit)**	$18	73%	$224	$11.7	$4.9	$7.7	8.5%	0%	20	9.7%	GDS 2007
Biomass (stoker)	$91	85%	$2,624	$72.9	$9.7	$37.6	8.5%	0%	20	9.7%	GDS 2007
Biomass (fluidized bed)	$98	85%	$2,915	$72.9	$9.7	$39.9	8.5%	0%	20	9.7%	GDS 2007
Anaerobic Digester (swine waste)	$98	75%	$3,887	$262.4	$0.0		8.5%	0%	20	9.7%	GDS 2007
Wind (onshore)	$94	27%	$1,749	$43.7	$1.9		8.5%	0%	20	9.7%	GDS 2007
Wind (offshore)	$122	33%	$2,721	$77.7	$1.9		8.5%	0%	20	9.7%	GDS 2007
Hydro Power (conventional)	$71	30%	$1,944	$11.7	$2.9		8.5%	0%	30	8.6%	GDS 2007
Hydro Power (small hydro)	$107	30%	$2,915	$19.4	$4.9		8.5%	0%	30	8.6%	GDS 2007
Hydro Power (low head)	$168	28%	$3,887	$48.6	$9.7		8.5%	0%	30	8.6%	GDS 2007
Nuclear power	$109	90%	$5,700	$110.0	$18.0	$15.0	8.5%		30	8.6%	Keystone, Moody's
Solar PV (utility scale)	$192	20%	$3,887	$14.6			8.5%	15%	20	9.7%	GDS 2007
Solar PV (commercial)	$292	20%	$5,831	$29.2			8.5%	15%	20	9.7%	GDS 2007
Solar PV (residential)	$395	20%	$7,775	$48.6			8.5%	15%	20	9.7%	GDS 2007
Small scale wind	$185	25%	$3,637	$50.0			8.5%		20	9.7%	CA SGIP; Synapse 2005
Small biomass	$101	90%	$3,500		$20.0	37.6	8.5%		20	9.7%	CA SGIP & Synapse 2005
Solar PV (res. & comm.)	$411	20%	$8,568	$11.48			8.5%	15%	20	9.7%	CA SGIP; WRA 2004.
Solar PV (utility scale)	$240	20%	$5,000		$4.0		8.5%	15%	20	9.7%	Tucson Electric Power 2003.

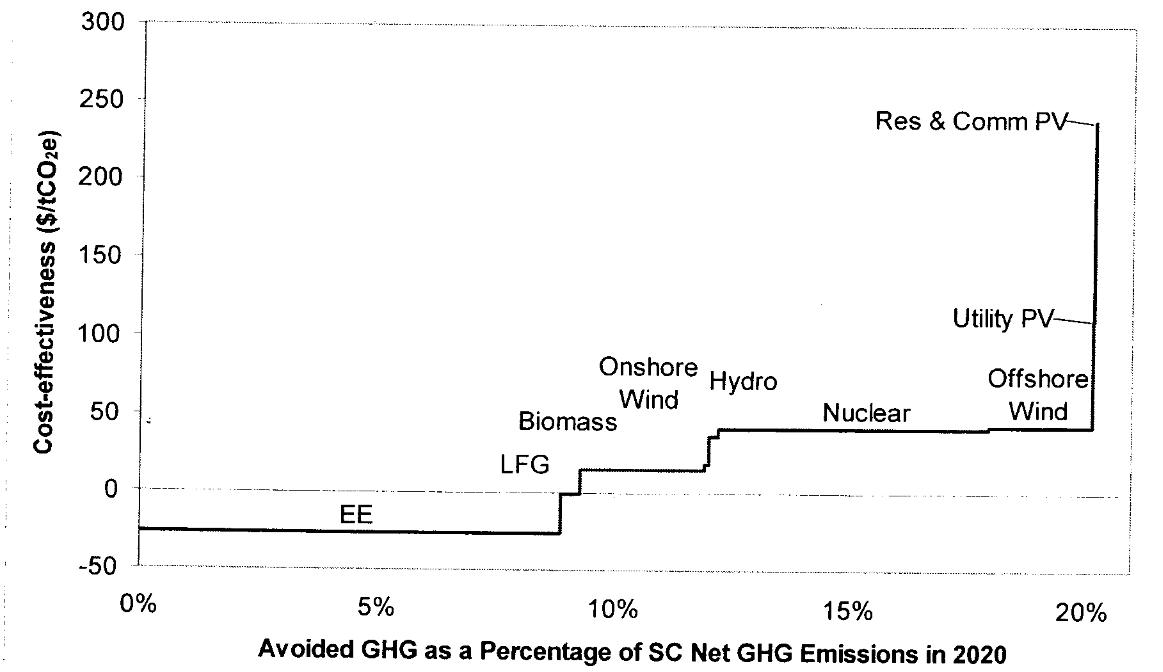
LCOE = levelized cost of electricity; O&M = operations and maintenance; PV = photovoltaic; res. & comm. = residential and commercial; WACC = weighted-average cost of capital; CRF = capital recovery factor; CA SGIP = California Self-Generation Incentive Program; kW = kilowatt; MWh = megawatt-hour.

*WACC assumption based on TWG consensus.

**Note that biomass co-firing costs are assumed to be incremental to the cost of coal generation, and thus do not have avoided energy costs associated with this resource.

Figure H-2 presents a supply curve of all of the available low-carbon and no-carbon resources considered in the ES-1 analysis. The quantity on the horizontal axis is the percentage of projected net South Carolina GHG emissions in 2020 avoided by full implementation of each resource.

Figure H-2. Supply curve of low- and no-carbon resources in South Carolina



$/tCO$_2$e = dollars per metric ton of carbon dioxide equivalent; EE = energy efficiency; GHG = greenhouse gas; LFG = landfill gas; res & comm = residential and commercial; PV = photovoltaic; SC = South Carolina.

Key Uncertainties

- Resource potential and cost for renewable resources.
- Nuclear costs and feasibility in 2020 timeframe.
- Avoided Cost of Electricity (Delivered): $55.75/MWh (2005$), a sales-weighted average for the state based on Duke Energy, Progress Energy, and South Carolina Electric & Gas avoided cost calculations. Avoided costs of electricity may not reflect the full costs of new generation planned in South Carolina. Future avoided costs are likely to be higher than they are today, which would improve the economic benefits of this policy.
- In the interest of advancing the recommended policies, the members are accepting the best available numbers as being reasonable, although individual members may disagree with certain assumptions.

Additional Benefits and Costs

Economic benefits of technology development in state, employment benefits.

Clean air benefits of nonfossil resources.

Nuclear waste management costs, risks.

Feasibility Issues

Resource potentials and economics.

Nuclear feasibility in 2020 timeframe.

Status of Group Approval

Complete.

Level of Support

Supermajority (three objections).

Barriers to Consensus

- *Objection 1*—Nuclear energy represents 50% of South Carolina's electricity production, while renewable energy is just getting started. A policy supporting development of new nuclear power should be a stand-alone policy, and should not be mixed with renewables.
- *Objection 2*—Objects to structuring these components as mandates, as opposed to strong targets.
- *Objection 3*—Prefers a strong mandate, but the fixed-goal nuclear costs are too high.

RCI-1. Energy Efficiency Programs, Funds, or Goals for Electricity (Residential, Commercial, and Industrial Sectors)

Policy Description

The efficiency with which electricity is used ("energy efficiency") can be improved in countless applications, thereby allowing increases in productivity for a fixed amount of electricity input, or producing the same results using less electricity. This policy focuses on increasing investment in electricity energy efficiency through programs run by utilities or others, energy efficiency funds, and/or energy efficiency goals. These options may be designed to work in tandem with other strategies recommended by the South Carolina Climate, Energy, and Commerce Advisory Committee (CECAC) that can also encourage efficiency gains.

National studies suggest that South Carolina has substantial potential to improve the efficiency of its energy use, with a 1% annual target being a reasonable and achievable target in the near term. However, South Carolina's efforts to date offer substantial room for improvement from 30th in the country in a 2006 ranking of state efforts.[1] Among states recognized as having strong performance, the Vermont Public Service Board has contracted for over 1% energy efficiency per year from 2006 through 2008. Xcel Energy in Colorado has agreed to achieve savings of 1.4% in 2013, which would offset 55% of forecast annual electricity load growth.[2] Like many other states and utilities, Xcel Energy's commitment matches the benchmark set out in the National Action Plan for Energy Efficiency: "Well-designed energy efficiency programs are delivering annual energy savings on the order of 1% of electricity and natural gas sales."[3]

Although there is no statewide energy efficiency market potential study for South Carolina, two recent studies have been conducted by South Carolina utilities on this topic. One evaluated the market potential for energy efficiency in Duke Energy's South Carolina service territory.[4] The draft study identifies a suite of energy efficiency programs and estimates an associated economic potential of 3,600 gigawatt-hours (GWh) of energy savings, or a 16% demand decrease, for this 14-county region in upstate South Carolina by 2026. Another study estimates the market potential in the service territories of the 20 state electricity cooperatives represented by Central

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[1] M. Eldridge, B. Prindle, D. York, and S. Nadel. *The State Energy Efficiency Scorecard for 2006*. Report Number E075. Washington, DC: American Council for an Energy Efficient Economy, June 2007. Available at: http://aceee.org/pubs/e075.pdf?CFID=3003167&CFTOKEN=36848811.

[2] D. York and M. Kushler. *A Nationwide Assessment of Utility Sector Energy Efficiency Spending, Savings, and Integration With Utility System Resource Acquisition*. Washington, DC: American Council for an Energy-Efficient Economy, 2006. Available at: http://www.eceee.org/conference_proceedings/ACEEE_buildings/2006/Panel_8/p8_29/.

[3] D. Munns and J. Rogers. *National Action Plan for Energy Efficiency*. U.S. Environmental Protection Agency and U.S. Department of Energy, July 2006, p. ES-4. Available at: http://www.epa.gov/cleanrgy/documents/napee/napee_exsum.pdf.

[4] Forefront Economics, Inc., H. Gil Peach & Associates, LLC, and PA Consulting Group. *Duke Energy Carolinas DSM Action Plan: South Carolina Draft Report*. Prepared for Duke Energy Carolinas. 2007. (Not available online.)

Electric Cooperative, Inc.[5] The findings point to a 20% demand decrease, or 4,000 GWh of energy savings, over a 10-year time frame assuming an 80% penetration rate. These numbers are consistent with findings from other studies in the Southeast.[6,7,8,9,10]

Considering that South Carolina has "low-hanging fruit" compared to states with well-established energy efficiency programs, the possibility of as much as a 2% annual reduction in energy use, including reductions in kilowatt hours (kWh), due to energy efficiency does not seem unreasonable. Therefore, South Carolina may be able to achieve a higher level of energy efficiency than 1% per year.

This policy would take a two-pronged approach to increasing the efficiency of electricity use in the state: implementing new or expanding existing electric utility energy efficiency programs for all sectors, and conducting consumer outreach on the value inherent in performance contracting and energy management programs for commercial, industrial, and institutional entities. To implement expanded electric energy efficiency programs, South Carolina could revise existing statutes to clarify support and to provide incentives for utility investments in cost-effective energy efficiency at the levels indicated above. It could also go further and add a value for carbon dioxide (CO_2) emissions to cost-effectiveness evaluations for energy efficiency. South Carolina also may need to clarify how municipal, cooperative, and state agency utilities will be held accountable for expected results.

Policy Design

Goals: Energy efficiency programs to reduce electricity use, adjusted for growth, by 1% per year by 2015 and by 1.5% per year by 2020.

Timing: Legislative and utility commission action in 2008, with an initial target of 0.25% in 2009, gradually increasing to 1% in 2015, and then to 1.5% in 2020.

Parties Involved: All electric utilities (public and private), regulators, and customers (all sectors).

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5 GDS Associates, Inc. "Electric Energy Efficiency Potential Study for Central Electric Cooperative, Inc.: Final Report." September 21, 2007. Accessed October 1, 2007, at: http://www.ecsc.org/newsroom/EfficiencyStudy.ppt.

6 F. Beck et al. *Powering the South: A Clean and Affordable Energy Plan for the Southern United States.* Washington, DC: Renewable Energy Policy Project, 2001. Available at: http://www.crest.org/articles/static/1/binaries/pts_repp_book.pdf.

7 Hedman, Bruce. "CHP Market Review." Energy and Environmental Analysis, Southeast Planning Session Presentation, July 6, 2005. (Not available online.)

8 La Capra Associates, Inc., GDS Associates, Inc., and Sustainable Energy Advantage. *Analysis of a Renewable Portfolio Standard for North Carolina.* Prepared for the North Carolina Utilities Commission. December 2006. Available at: http://www.ncuc.commerce.state.nc.us/rps/NC RPS Report 12-06.pdf.

9 J. Tiller. "Energy Efficiency Opportunities for North Carolina Buildings and Industrial Facilities. Boone, NC: Appalachian State University, 2007. (Not available online.)

10 B. Hedman. "CHP Market Review." Energy and Environmental Analysis, Southeast Planning Session Presentation, July 6, 2005. (Not available online.)

Other: This policy would implement electric utility energy efficiency programs for all sectors, as well as an educational awareness campaign showing the value inherent in performance contracting and energy management programs for commercial, industrial, and institutional entities.

Implementation Mechanisms

Energy Performance Contracts: Commercial, Industrial, and Institutional Sectors

This policy would include an educational awareness campaign targeted at the commercial, industrial, and institutional sectors, to show the value inherent in performance contracting and energy management programs. An energy savings performance contract (ESPC) is a contracting vehicle that allows agencies or other entities to accomplish energy projects for their facilities without up-front capital costs. The energy service company (ESCO) conducts a comprehensive energy audit, identifies improvements that will save energy at the facility, works with the customer to design and construct a project that meets the agency's needs, and arranges financing to pay for it. The ESCO guarantees that the improvements will generate savings sufficient to pay for the project over the term of the contract. After the contract ends, all additional cost savings accrue to the customer. An ESPC may include lighting improvements; building envelope modifications; chilled-water, hot-water, and steam distribution systems; electric motors and drives; refrigeration; electricity peak shaving or load shifting; and energy-related process improvements.

Goals and Incentives: All Sectors

This policy would also implement specific goals and incentives for energy efficiency for all electricity consumers. Policy and administrative mechanisms that might be used to implement electric energy efficiency programs include:

- Verified savings targets;
- Public benefit charges (option for industry to not participate in funding pool contribution) allocated to a state agency, third-party "efficiency utility," or utilities;
- Portfolio standards;
- Energy trusts;
- Integrated resource planning;
- Performance-based incentives; and
- Appropriate rate treatment for efficiency.

Among the measures that would be expected to be implemented to achieve these economy-wide goals are:

- Energy audits for homeowners, businesses, industries, consumer education, and energy end-use surveys;
- Incentives for specific technologies, potentially including lighting, water heating, plug loads, networked personal computer management, power supplies, motors, pumps, boilers, customer-side transformers, water use reduction, ground-source heat pumps, and others;

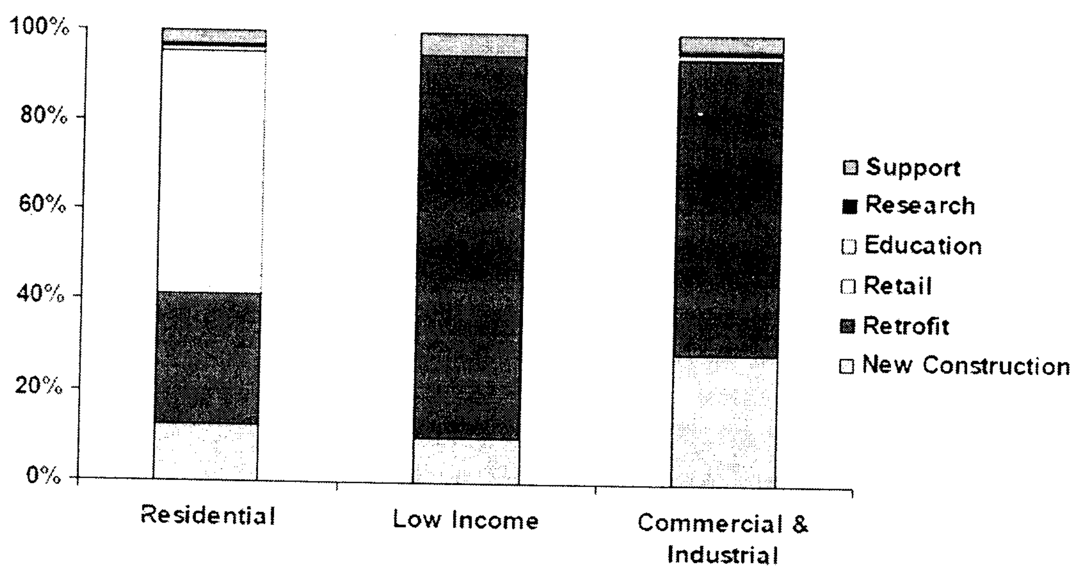
- Energy efficiency reinvestment funds;
- Evaluation of the economic and conservation impacts of incentive programs; and
- Complementary policies, such as appliance recycling/pickup programs.

Types of Energy Efficiency Measures in an Electric Energy Efficiency Portfolio

The Massachusetts investor-owned utility (IOU) efficiency programs have achieved high energy savings from their portfolios. Although adjustment to this sample portfolio is appropriate for South Carolina (especially to the focus on lighting in Massachusetts), the Massachusetts portfolio could provide a starting point for designing efficiency programs for South Carolina.

Massachusetts IOU efficiency programs are classified under two major categories: productive and supportive. Programs under productive strategies include New Construction, Retrofit, and Retail, which account for 95% of the all programs. Programs under supportive strategies include Program Support, Research, and Education. As shown in Figure G-1, residential programs focus on retail, encouraging customers to buy ENERGY STAR lights and other measures. Low-income programs mainly help residents of existing buildings to lower their energy bills by retrofitting old, inefficient measures in the buildings with new, efficient measures (e.g., lighting, refrigeration, heating, ventilation, and air conditioning [HVAC] measures). Finally, the Commercial & Industrial programs mainly focus on investment in higher energy efficiency for new construction and major renovation projects.

Figure G-1. Percentage of expenditures for Massachusetts IOU energy efficiency measures by strategy and sector: 2003–2005



IOU = investor-owned utility.

Source: Commonwealth of Massachusetts, Executive Office of Energy and Environmental Affairs (2007).

However, the actual portfolios of energy efficiency programs by leading utilities often tell a different story. Utility programs generally include measures ranging from zero (or even negative) net cost per kWh saved up to (and in rare occasions exceeding) avoided costs. Often the portfolio includes some measures related to customer, retailer, and vendor education and market transformation that will not save any energy immediately, but could have a significant impact on the landscape of energy efficiency measures available in the long run. Given this background, we will present a brief summary of the GDS Associates study.

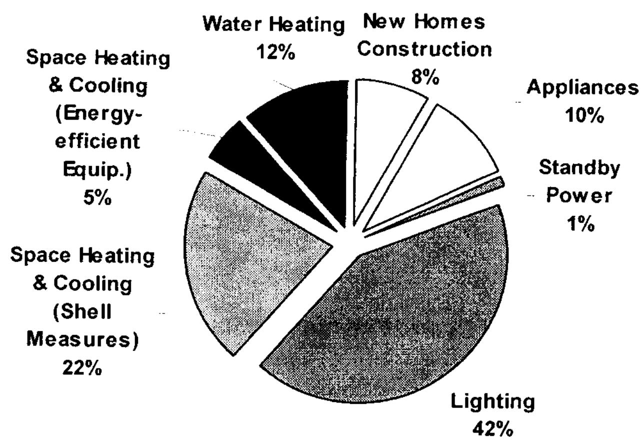
GDS presents three market penetration scenarios for achievable cost-effective electricity energy efficiency potential in the residential sector: 20% penetration, equivalent to about 4% energy savings by 2017; 50% penetration, yielding about 11% energy savings by 2017; and 80% penetration, projected to save 21% by 2017. RCI-1 calls for approximately 6% reduction in load by 2017. For GDS's 20% penetration scenario shown in Figure G-3, in which low-cost energy efficiency measures are adopted first, lighting measures comprise a smaller portion of energy-saving potential in a hypothetical portfolio (42%) than in Massachusetts (54%), whereas water heating is a greater portion (12% in GDS's 20% penetration scenario, versus 6% for Massachusetts).[13] As shown in Figure G-4, lighting measures become even less prominent (34%), and hot-water measures become more prominent (16%), in the more aggressive GDS 50% penetration scenario.

Related Policies/Programs in Place

- April 16, 2007, Energy Efficiency Summit, sponsored by Duke Power, South Carolina Energy Office (SCEO), South Carolina Department of Health and Environmental Control (SC DHEC), and others.
- SCEO tracks utility programs.
- South Carolina currently has enabling legislation in place for performance contracting as a result of the South Carolina Energy Conservation and Efficiency Act of 1992. A growing number of federal, state, and local government agencies in South Carolina as well as private industry have chosen to evaluate potential energy-saving project measures within their facilities and pursue ESPCs as a preferred arrangement to fund these projects. Some of the agencies, institutions, and industrial entities in South Carolina that pursued and implemented projects using performance contracting include Winthrop University, Veterans Integrated Service Network 7 hospitals, Fort Jackson, BMW Manufacturing Corp., and the University of South Carolina. Entities that are currently developing energy use management projects using performance contracting include The Citadel, the City of Columbia, Columbia Housing Authority, and Medical University of South Carolina.

[13] Note that the Massachusetts report provides avoided costs. In reality, lighting savings accounts for the majority of the total energy savings. See: Commonwealth of Massachusetts, Executive Office of Energy and Environmental Affairs. *Massachusetts Saving Electricity: A Summary of the Performance of Electric Efficiency Programs Funded by Ratepayers Between 2003 and 2005*. April 2, 2007. Available at: http://www.mass.gov/Eoca/docs/doer/pub_info/ee03-05.pdf.

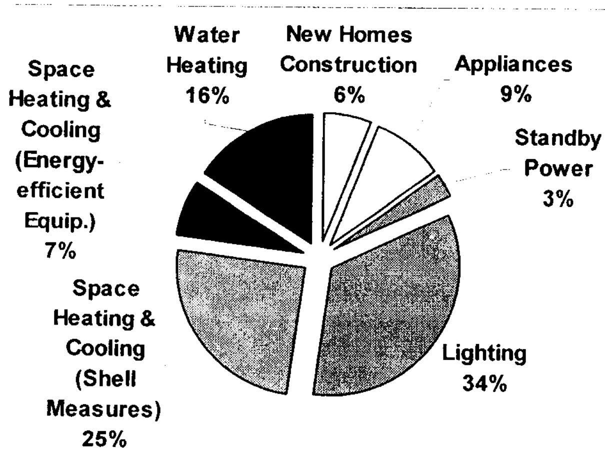
Figure G-3. Residential sector end-use savings as a percentage of total achievable cost-effective potential by measure type for the CEPCI service territory (20% penetration scenario)



CEPCI = Central Electric Power Cooperative, Inc.

Source: GDS Associates, Inc. (2007).

Figure G-4. Residential sector end-use savings as a percentage of total achievable cost-effective potential by measure type for the CEPCI service territory (50% penetration scenario)



CEPCI = Central Electric Power Cooperative, Inc.

Source: GDS Associates, Inc. (2007).

Type(s) of GHG Reductions

Reduction in greenhouse gas (GHG) emissions (largely CO_2) from avoided electricity production.

Estimated GHG Reductions and Net Costs or Cost Savings

Table G-1 presents the estimated GHG reductions and net costs or costs savings from implementing RCI-1.

Table G-1. Estimated GHG reductions and net costs of or cost savings from RCI-1

Policy	GHG Reductions ($MMtCO_2e$)			Gross Cost (Million $)	Gross Benefits (Million $)	Net Present Value 2009–2020 (Million $)	Cost-Effectiveness ($/t$CO_2e$)
	2012	2020	Total 2009–2020				
RCI-1 Total	1.5	8.2	43.0	$987	–$2,114	–1,127	–$26

GHG = greenhouse gas; MMtCO2e = million metric tons of carbon dioxide equivalent; $/tCO2e = dollars per metric ton of carbon dioxide equivalent.

Data Sources:

Cost of Energy Efficiency Measures:

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- Martin Kushler, Dan York, and Patti White, *Five Years In: An Examination of the First Half-Decade of Public Benefits Energy Efficiency Policies,* Washington, DC: American Council for an Energy Efficient Economy, April 2004. Available at: http://www.aceee.org/pubs/u041.htm.
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- Heschong Mahone Group, Inc., *New York Energy $mart*[SM] *Program Cost-Effectiveness Assessment*, prepared for New York State Energy Research and Development Authority, June 2005. Available at: http://www.nyserda.org/Energy_Information/ContractorReports/Cost-Effectiveness_Report_June05.pdf.

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- [IPL] Interstate Power & Light, 2006 Company Demand Side Management (DSM) Filing under Docket No. 05-581.01. Available at: https://www.edockets.state.mn.us/EFiling/search.jsp.
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Energy Efficiency Potential:

- GDS Associates, Inc., "Electric Energy Efficiency Potential Study for Central Electric Cooperative, Inc.: Final Report," September 21, 2007. Accessed on October 1, 2007, at: http://www.ecsc.org/newsroom/EfficiencyStudy.ppt.
- Forefront Economics, Inc., H. Gil Peach & Associates, LLC, and PA Consulting Group, *Duke Energy Carolinas DSM Action Plan: South Carolina Draft Report,* prepared for Duke Energy Carolinas, July 24, 2007. (Not available online.)

Avoided Cost of Electricity (Delivered):

- Duke Energy Carolinas, LLC Filing to South Carolina Public Service Commission (SCPSC): "Proceeding for Approval of the Public Utility Regulatory Policies Act of 1978 (PURPA) Avoided Cost Rates for Electric Companies—Letter Regarding Revisions to Schedule PP (SC)," July 27, 2007. Available at: http://dms.psc.sc.gov/matters/matters.cfc?Method=MatterDetail&MatterID=187531.
- Progress Energy Filing to SCPSC: "Proceeding for Approval of the Public Utility Regulatory Policies Act of 1978 (PURPA) Avoided Cost Rates for Electric Companies—Letter Regarding Revised Schedule CSP-23," November 29, 2007. Available at: http://dms.psc.sc.gov/attachments/8D4605A3-D0C6-1E0B-7E9AFC3D3422E8A0.pdf.
- South Carolina Electric & Gas Company, "Preliminary Avoided Costs To Be Used For Purchases From Small Power Producers," received by e-mail from Henry Barton of SCANA Corporation, 2008. (Not available online.)

Quantification Methods:

- Project energy savings based on the stated electricity savings target (a 1% per year reduction in total annual consumption by 2015, increasing to 1.5% per year by 2020). Adjust annual electricity consumption each year based on the previous year's energy efficiency impacts.
- Estimate the total cost of electricity savings using state-specific or region-specific data on the cost of saved energy from electricity energy efficiency measures.
- Estimate the GHG emission reductions through the electricity energy efficiency measures.

Key Assumptions:

Discount Rate: 5% real.

Avoided Cost of Electricity (Delivered): \$55.75 per megawatt-hour (MWh) (2005\$), a sales-weighted average for the state based on Duke Energy, Progress Energy, and South Carolina Electric & Gas avoided cost calculations. The actual implications of avoided electricity may be different for customers.

Transmission and Distribution (T&D) Electricity Losses: 6% (consistent with the Energy Supply assumptions).

Cost of Energy Efficiency Measures:

- For Duke Energy: 500 gigawatt-hours (GWh) of annual savings in the residential sector and about 300 GWh of annual savings in the nonresidential sector at a cost of about \$0.03 per kWh of saved electricity. For a comparison, Duke Energy's annual electricity sales are 5,440 GWh according to the U.S. Department of Energy's (DOE's) Energy Information Administration (EIA).[14]

- For North Carolina: See Table G-2.

Table G-2. Cost of energy efficiency measures for North Carolina

Sector	Present Value of Total Costs (2006$)	Value of Lifetime kWh Savings—Customer Meter Level	Levelized Cost per Lifetime kWh Saved
Residential sector	$262,528,658	9,673,701,174	$0.027
Commercial sector	$352,185,339	8,702,321,930	$0.040
Industrial sector	$124,388,270	6,805,459,342	$0.018
Total—All Sectors	**$739,102,267**	**25,181,482,446**	**$0.029**

kWh = kilowatt-hour. Source: GDS Associates, Inc. (2006).

For other states: See Table G-3.

Table G-3. Cost of energy efficiency measures for other states

State/Utility	CSE ($/kWh)	Program Year	Source
Western Utilities	0.025	1978–2004	Energy Efficiency Task Force 2006[15]
Northwest Energy	0.02	2006	Montana PSC Docket No.: D2005.5.88 07/12/06[16]
New York	0.03	2004	Heschong Mahone Group, Inc. 2005[17]
Massachusetts IOUs	0.038	2002	Gene Fry 2003[18]
California	0.03	n/a	Kushler et al. 2004[19]
Connecticut	0.023	n/a	Kushler et al. 2004
New Jersey	0.03	n/a	Kushler et al. 2004
Vermont	0.03	n/a	Kushler et al. 2004

[14] Forefront Economics, Inc., H. Gil Peach & Associates, LLC, and PA Consulting Group. *Duke Energy Carolinas DSM Action Plan: South Carolina Draft Report.* Prepared for Duke Energy Carolinas. July 24, 2007. (Not online.)

[15] Energy Efficiency Task Force. *The Potential for More Efficient Electricity Use in the Western United States.* Report to the Clean and Diversified Energy Advisory Committee of the Western Governors' Association. Denver, CO: Western Governors' Association, January 2006. Available at: http://www.westgov./wga/initiatives// %20Efficiency-full.pdf.

[16] Montana Public Service Commission. Docket No. D2005.5.88 07/12/06. Available at: http://www.psc.state.mt.us/eDocs/.

[17] Heschong Mahone Group, Inc. *New York Energy $mart℠ Program Cost-Effectiveness Assessment.* Prepared for New York State Energy Research and Development Authority. June 2005. Available at: http://www.nyserda.org/Energy_Information/ContractorReports/Cost-Effectiveness_Report_June05.pdf.

[18] G. Fry. "Massachusetts Electric Utility Energy Efficiency Database." Massachusetts Department of Telecommunications and Energy, 2003 edition. (Not available online.)

[19] M. Kushler, D. York, and P. White. *Five Years In: An Examination of the First Half-Decade of Public Benefits Energy Efficiency Policies.* Washington, DC: American Council for an Energy Efficient Economy, April 2004. Available at: http://www.aceee.org/pubs/u041.htm.

IOUs = investor-owned utilities; \$/kWh = dollars per kilowatt-hour; CSE = cost of saved energy; N/A = not applicable; PSC = Public Service Commission.

Responding to CECAC member concerns, the Center for Climate Strategies (CCS) conducted a review of data on the costs and performance of electricity energy efficiency programs by several utilities over multiple years to determine whether empirical data support a change in the cost of saved energy at higher levels of program penetration. Two metrics were considered: (1) annual utility costs of electricity energy efficiency programs per MWh saved (i.e., the utility's levelized cost of saved energy), in comparison to annual incremental savings as a percentage of annual sales (in Figure G-5 below); and (2) the utility's levelized cost of saved energy, in comparison to projected lifetime energy savings from measures installed in that year (in Figure G-6 below).[20]

Review of the trends in costs of electricity energy efficiency programs at different penetration levels (see Figures G-5 and G-6) reveals a few cases where costs increased as the penetration increased, but the overall cost trend for each data set shows that the costs of energy savings tend to decrease as the penetration increases. Although the reason for the decreasing costs is not specifically reflected in these data sets, there are several likely causes. Two metrics—savings as a percentage of sales and savings as a percentage of total projected savings—indicate that energy efficiency programs can achieve economies of scale at higher savings levels (incremental savings of 1%–2% of annual sales). Theoretically, a company can enjoy economies of scale by expanding its operation of energy efficiency programs. For example, a large program allows for bulk purchase of certain efficiency measures, which allows for a company to purchase them at a lower price per unit. In another instance, large-scale programs can allocate the costs of marketing and administration of those programs over greater amounts of energy savings, which would tend to reduce the program cost per kWh saved as the program scale increases.

Also, marketing and customer education will increase customers' adoption of new technologies, which in turn will accelerate the mass production of such technologies and, thus, reduce the price per unit in the long term.

Figure G-5 also suggests that more aggressive programs (relative to the size of each utility) may be more effective as a result of higher budget levels. For example, higher spending relative to annual sales may allow a company to invest in better program management and design.

The levelized cost of saved energy was estimated based on (1) a 4% discount rate; (2) the first-year savings divided by the first-year "program investment" (excluding participants' contribution of purchasing efficient appliances and measures); and (3) projected lifetime savings and the associated useful program life.

Efficiency Measure Lifetime: 13 years on average.

Displaced Emissions, Electricity: 237 tons of CO_2-equivalent emissions per billion British thermal units (tCO_2e/Bbtu), average 2008–2020, based on North Carolina analysis by CCS. Energy efficiency measures are assumed to displace generation from existing facilities in the

[20] Utility costs include program administration, marketing, customer rebates, and utility incentives; they do not include participants' contribution to purchase efficient appliances.

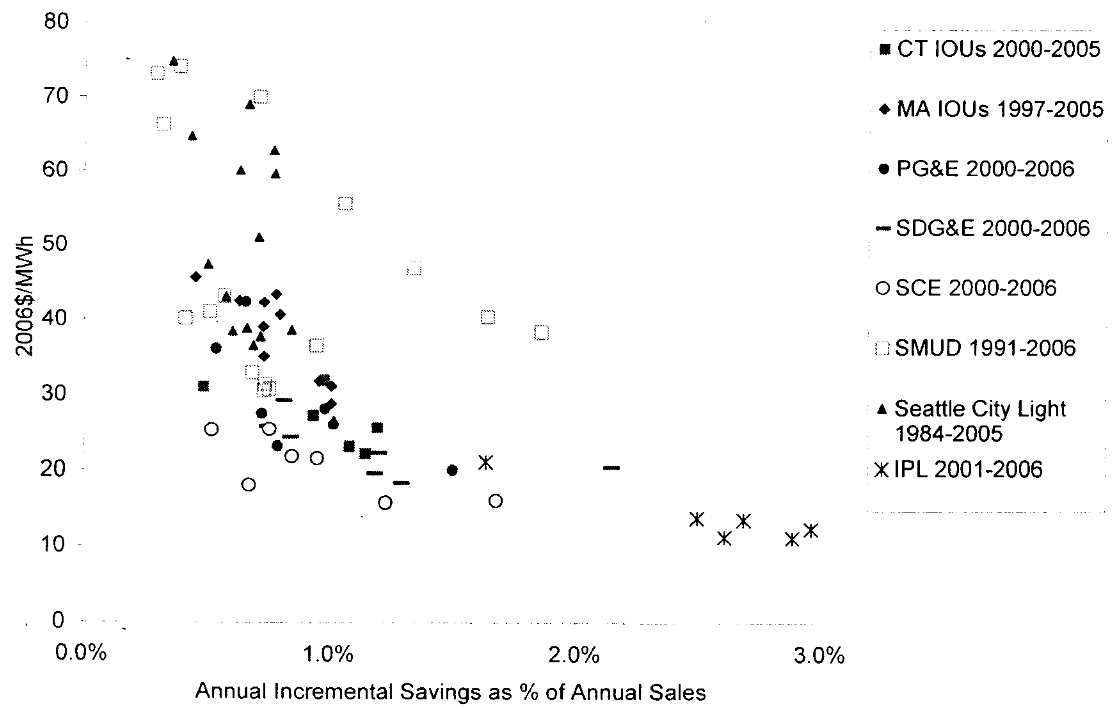
short term and to contribute to postponing the construction of new conventional power plants in the long term.

Key Uncertainties

Current avoided costs of electricity may not reflect the full costs of new generation. Future avoided costs are likely to be higher than they are today, which would improve the attractiveness of energy efficiency.

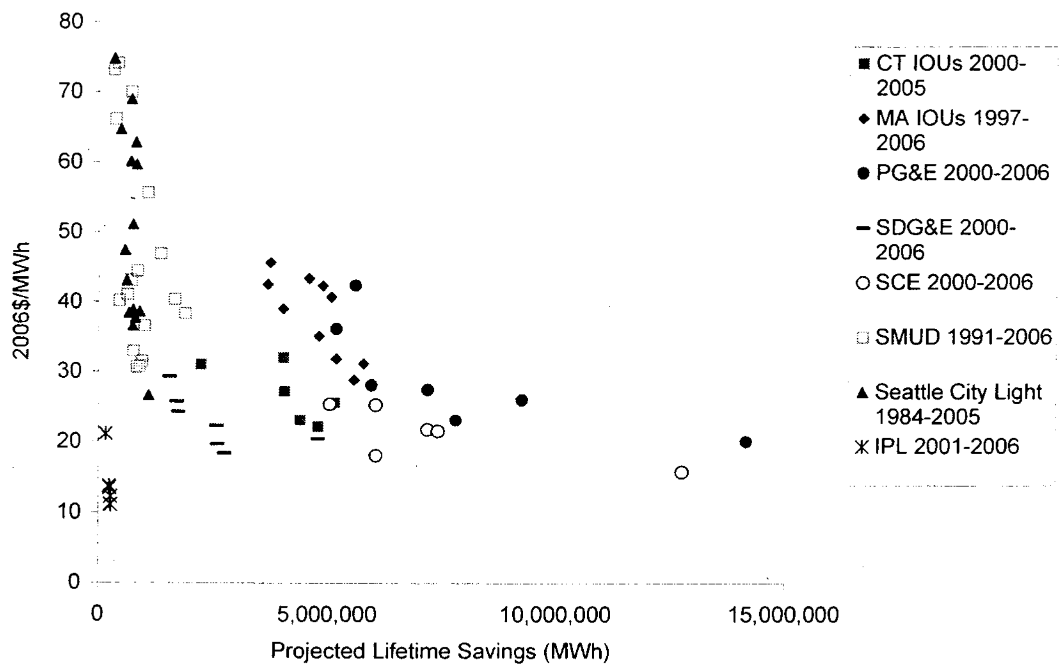
The source of funding to implement the electric energy efficiency programs envisioned here is uncertain. Consumer response is also uncertain.

Figure G-5. Utility cost of saved energy (2006$) vs. annual incremental savings as a percentage of sales



CT IOUs = Connecticut investor-owned utilities; MA IOUs = Massachusetts investor-owned utilities; PG&E = Pacific Gas and Electric; SCE = Southern California Edison; SMUD = Sacramento Municipal Utility District; IPL = Interstate Power & Light; MWh = megawatt-hour.

Figure G-6. Utility cost of saved energy (2006$) vs. projected lifetime savings



CT IOUs = Connecticut investor-owned utilities; MA IOUs = Massachusetts investor-owned utilities; PG&E = Pacific Gas and Electric; SCE = Southern California Edison; SMUD = Sacramento Municipal Utility District; IPL = Interstate Power & Light; MWh = megawatt-hour.

Additional Benefits and Costs

- Savings to consumers and businesses on energy bills, which can have macroeconomic benefits. Benefits to low-income households by reducing utility costs.
- Electricity system benefits: reduced peak demand, reduced capital and operating costs, improved utilization and performance of the electricity system.
- Reduced risk of power shortages.
- Reduced pollutants from emissions, improved health from fewer pollutants and particulates, and reduced water use for cooling.
- "Green-collar" employment expansion and economic development.
- Reduced dependence on imported fuel sources.
- Reduced energy price increases and volatility.

Feasibility Issues

None noted.

Status of Group Approval

Complete.

Level of Group Support

Unanimous.

Barriers to Consensus

Not applicable.